



# Operations and Maintenance Manual

Virginia Electric and Power Company  
Possum Point Power Station  
Coal Combustion Residual Surface Impoundment Closures  
Dumfries, Virginia

GAI Project Number: C150132.00, Task 050

May 2016

***Revised September 2016***



**Dominion<sup>SM</sup>**

Prepared by: GAI Consultants, Inc.  
Richmond Office  
4198 Cox Road, Suite 114  
Glen Allen, Virginia 23060-3328

Prepared for: Virginia Electric and Power Company  
5000 Dominion Boulevard  
Glen Allen, Virginia 23060-3308

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- ▶ Description of Operational Change;
- ▶ Reason for Operational Change;
- ▶ Additional Comments, as needed; and
- ▶ Signature of Recording Individual(s).

### 3.4 Treatment System Corrective Actions

While the treatment system is operated, unit processes will be regularly monitored by Glover and Carbonair/ProAct staff to evaluate the performance of the treatment system. Corrective actions to improve the performance of the treatment system will be implemented as soon as practical.

## 4.0 Sampling

### 4.1 In-Line Process Sampling

#### 4.1.1 Sampling Procedure

In-line process samples will be collected from a sample tap located after the treatment unit process and prior to the temporary storage tanks. Sample containers will be pre-labeled by **Engineering Consultant** staff using the following nomenclature:

- ▶ Year (##) Month (##) Day (##) Time (24-hour ####) Treatment ID; and
- ▶ YYMMDD-HHMM-TID.

The following Treatment ID (TID) will be used to identify whether the sample was collected when implementing enhanced treatment:

- ▶ Before Enhanced Treatment: BET;
- ▶ After Enhanced Treatment: AET; and
- ▶ Others, as required.

In-line process samples should be collected every **one hour**, or as needed based on flow, by **Engineering Consultant** personnel during operation of the treatment system. Should delays be expected for collecting or communicating results of in-line process samples, **the Engineering Consultant** should notify ProAct immediately.

Figure 4 includes a process flow diagram of the treatment system that will be operational at Possum Point during decanting and dewatering activities. This diagram identifies the location of in-line process sampling point.

**Engineering Consultant** employees will collect one grab sample per hour (or as needed) using a laboratory-supplied sample container. The sampler will deliver each sample to the mobile analytical laboratory immediately upon collection.

A table outlining suggested in-line process monitoring parameters and sampling frequency is shown in Table 9.

**Table 9**  
**Internal Process Monitoring Parameters and Sampling Frequency**

Sample Location	Parameters to be Analyzed	Frequency of Grab Sample	Process Monitoring Limits
Treatment System Effluent <b>Sampling Port</b>	Metals (by PACE)	Once every <b>one hour or as needed depending on flow.</b>	See Table 8 and Figure 7

#### 4.1.2 In-Line Process Sample Analytical Testing

In-line samples should be analyzed as suggested in the following table:

**Table 10**  
**In-Line Process Monitoring Constituents, Equipment, and Procedures**

Constituent	How to Monitor	Instrument Make and Model	Procedure
Arsenic	ICP-MS	Perkin Elmer NexION 350 ICP-MS Spectrometers	EPA 200.8
Cadmium			
Chloride			
Copper			
Lead			
Mercury			
Nickel			
Selenium			
Thallium			
Zinc			

The mobile PACE laboratory will prepare and analyze the in-line process samples as soon as they are received, providing sample results within one hour of delivery, or as needed. It is anticipated that in-line process sample collection and analysis will be optimized to achieve a sample turnaround time of approximately **one hour or as needed based on flow.**

#### 4.1.3 In-Line Process Sample Results and Reporting

Once analytical results are obtained, PACE will forward them to **the Engineering Consultant**. A process flow chart outlining the procedure for in-line process sample collection and communication of sample results is shown in Figure 7. This flow chart is to be used in conjunction with Table 8 for determination when Enhanced Metals Treatment should be activated/inactivated and whether the Internal Outfall 503 is compliant and suitable for discharge.

## 4.2 Compliance Monitoring Sampling

Compliance monitoring sampling will be conducted in accordance with the Final VPDES Permit VA0002071 issued by the VDEQ with Major Modification dated January 14, 2016 and expiring on April 2, 2018. **The Engineering Consultant** has prepared a document entitled *Internal Outfall 503 Sampling Plan* attached in Appendix D that outlines the procedure for collection, preservation, analysis and reporting of compliance samples. A process flow chart outlining the procedure for compliance sample collection and communication of results is shown in Figure 8.

## **APPENDIX D**

### **Internal Outfall 503 Sampling Plan**





## Internal Outfall 503 Sampling Plan ***Revision 1***

Virginia Electric and Power Company  
Possum Point Power Station  
Coal Combustion Residual Surface Impoundment Closures  
Dumfries, Virginia

Project Number: C150132.00, Task 050

April 2016

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# Internal Outfall 503 Sampling Plan

## ***Revision 1***

Virginia Electric and Power Company  
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Drawing C150132-00-050-00-P-B2-001 Sheet 2: Details

Drawing C150132-00-050-00-P-B2-001 Sheet 3: Details

Appendix A Outfall 503 (Interim/Final) Final Permit Discharge Monitoring/Limits

Appendix B Field Report Templates for Compliance Monitoring

Appendix C ISCO 6172FR Flow Paced Sampler Catalog Cut

Appendix D ISCO 6172FR Flow Paced Sampler Installation Instructions

Appendix E ISCO 6172FR Flow Paced Sampler Programming Instructions and Information

Appendix F Greyline TTFM 1.0 Catalog Cut

Appendix G Greyline TTFM 1.0 Installation Instructions

Appendix H Sample Outfall 503 Discharge Monitoring Report for Each Sample Event

Appendix I Example Monthly Discharge Monitoring Report to DEQ

## 1.0 Project Overview

Virginia Electric and Power Company (Dominion) is in the process of implementing a long-term strategy for closure of its existing coal combustion residuals (CCR) (ash) ponds at the Possum Point Power Station (Station), an 1,845 megawatt, natural gas and oil fired (previously coal-fired) steam electric generating station near Dumfries, Prince William County, Virginia (VA).

### 1.1 Introduction

Dominion is currently working to close five existing ash ponds at the Station: Ash Ponds A, B, C, D, and E. All five ponds are scheduled for closure in accordance with the relevant provisions of the United States Environmental Protection Agency's CCR Rule, which was published on April 17, 2015, and codified in 40 Code of Federal Regulations (CFR) Part 257, Subpart D. A drawing showing the site plan is shown on Figure 1.

Ash Ponds A, B, and C were originally three contiguous ponds that have been inactive since the 1960s. Ash Ponds A, B, C, and E have been decanted and are being dewatered until all ash material has been removed, in accordance with applicable state and local requirements. Dredged ash material from the ponds **is being placed in Ash Pond D in accordance with the VA Pollutant Discharge Elimination System (VPDES) Permit.**

Ash Pond D is **currently being** decanted **and** dewatered, **and will be** regraded, capped, and closed in the coming months. During the decanting and dewatering process, water from Ash Pond D will be treated and discharged to Outfall 001/002 via Internal Outfall 503. Following dewatering, Ash Pond D will be converted to a single regulated solid waste facility subject to all applicable state and federal closure and post-closure care requirements.

### 1.2 Project Description

This Sampling Plan addresses the planned procedures for sampling and analyzing water qualities for the following in accordance with the Final **VPDES** Permit VA0002071 issued by the VA Department of Environmental Quality (DEQ) with Major Modification Date of January 14, 2016 and expiring on April 2, 2018:

- Grab, four-hour flow paced, and 24-hour flow paced sampling and analyses of discharged waters from Internal Outfall 503 - [Comingled Process Water, Ash Dewatering Water, Contact Water (Interim)/Ash Pond D Underdrain/Outfall 010/Interim Outfall 501 (Final)] - When Routed to Outfall 001/002 or Outfall 004.

Discharges from Internal Outfall 503 during the "Interim Configuration" during construction (from the closure activities of Ash Ponds A, B, C, D, and E) consist of comingled process water in Pond D (i.e., Pond D Comingled Water) as well as Ash Dewatering Water, and stormwater in contact with ash (i.e., Contact Water). Pond D Comingled Water consists of a combination of stormwater as well as the following waters that have been comingled in Pond D as a result of the closure activities of Ash Ponds A, B, C, D, and E:

- ash dewatering water;
- contact water;
- metals cleaning waste (Outfall 501 water); and
- oil water (Outfall 502 water).

Pond D Comingled Water must be drained from Pond D to allow for the closure of Ash Pond D. Pond D Comingled Water includes an estimated 158 million gallons that has accumulated in Pond D as

identified from a 2015 bathymetric survey and a water surface elevation surveyed on February 16, 2016.

Discharged waters from Internal Outfall 503 for the "Final Configuration" (i.e., following the closure activities of Ash Ponds A, B, C, D, and E) consist of Ash Pond D Underdrainage and Outfall 501 Water with potential for Pond D Toe Drainage. Pond D Toe Drainage consists of underflow from the Pond D Impoundment. Ash Pond D Underdrainage refers to future subsurface waters draining from closed and capped Pond D soil/ash below the proposed impermeable liner. Underdrainage waters are expected to reduce over time and eventually stop flowing.

Discharges of waters from Internal Outfall 503 are planned to be routed to Outfall 001/002.

## 2.0 Monitoring Objectives

The Final VPDES Permit for Industrial Wastewater Discharges (Permit) includes effluent limitations and monitoring requirements for Internal Outfall 503 for "Interim" and "Final Configurations". The effluent limitations and monitoring requirements for Internal Outfall 503 - When Routed to Outfall 001/002 or Outfall 004 are provided in Appendix A.

## 3.0 Sampling Locations

**Water** samples **will be collected** at the approximate locations defined in Table 1 or in alternate equivalent locations, e.g., upstream on the conveyance pipeline that discharges to Outfall 503. The proposed sample locations, discharge sources, treatment, average flow, and approximate coordinates (latitude and longitude) are as follows:

**Table 1**  
**Outfall Sample Locations**

Outfall	Discharge Sources	Potential Treatment	Maximum Flow	Latitude and Longitude
503 (Interim Configuration)	Comingled Process Water, Ash Dewatering Water, Contact Water	Aeration, Chemical Addition, Clarification, Filtration, Activated Alumina, and/or Ion Exchange	2.88 MGD <sup>1</sup>	Location to be Determined
503 (Final Configuration)	Ash Pond D Underdrain, Internal Outfall 501, Potentially Pond D Toe Drainage	Technology to be Determined	2.88 MGD <sup>1</sup>	Location to be Determined

Note:

<sup>1</sup> MGD = Million gallons per day.

## 4.0 Frequency of Sampling

Four-hour and 24-hour composite flow proportioned samples as well as grab samples are to be collected three times a week or once a month at Internal Outfall 503 as required by the Final Permit (refer to Appendix A). The frequency of sampling each parameter at the outfall is shown below in Tables 2 and 3.



**Table 2**  
**Internal Outfall 503 Weekly Monitoring**

Constituent	Sample Frequency <sup>1</sup> and Collection Method
Flow (MGD <sup>2</sup> )	3/W Estimate
pH	3/W Grab
Total Suspended Solids	3/W 4H-C
Oils and Grease	
Antimony, Total	
Arsenic, Total	
Cadmium, Total	
Chloride	
Chromium, Total <sup>3</sup>	
Chromium III, Total	
Chromium VI, Total	
Copper, Total	
Lead, Total	
Mercury, Total	
Nickel, Total	
Selenium, Total	
Silver, Total	
Thallium, Total	
Vanadium, Total	
Zinc, Total	
Hardness, Total (as CaCO <sub>3</sub> )	

Notes:

<sup>1</sup> **Frequency Definitions:**

- a. 3/W = three days per week.
- b. Estimate = Reported flow based on technical evaluation of sources belonging to the discharge.
- c. Grab = an individual sample over a period of time not to exceed 15 minutes.
- d. 4H-C = four-hour flow proportional composite sample.

<sup>2</sup> **MGD = Million gallons per day.**

- <sup>3</sup> Total Chromium analysis is required to calculate Chromium III; although permit does not require monitoring/reporting of total Chromium.

**Table 3**  
**Internal Outfall 503 Monthly Monitoring**

Constituent	Sample Frequency <sup>1</sup> and Collection Method
Aluminum, Total	1/M 4H-C
<b><i>Aluminum, Dissolved</i></b>	
Barium, Total	
Beryllium, Total	
<b><i>Beryllium, Dissolved</i></b>	
Boron, Total	
Cobalt, Total	
Iron, Total	
Molybdenum, Total	
Vanadium, Total	
48-Hour Static Acute Toxicity Test using <i>Ceriodaphnia dubia</i>	1/M 24H-C
48-Hour Static Acute Toxicity Test using <i>Pimephales promelas</i>	
Chronic 3-Brood Static Renewal Survival and Reproduction Test using <i>Ceriodaphnia dubia</i>	
Chronic 7-Day Static Renewal Survival and Growth Test using <i>Pimephales promelas</i>	

Note:

<sup>1</sup> **Frequency Definitions:**

- a. 1/M = Once per month.
- b. 4H-C = four-hour flow proportional composite sample.
- c. 24H-C = 24-hour flow proportional composite sample.

## 5.0 Field Sampling Procedures

***For the purpose of this work, only those laboratories that are capable of meeting the quality standards specified herein will be utilized. Additionally, all laboratories will be preapproved by Dominion prior to utilization. Two or more laboratories may be used at a time, as toxicity is a specialized analysis not conducted by most laboratories, whereas toxicity laboratories generally do not analyze for more conventional analyses, such as metals, TSS, oil and grease, and chloride.***

***All bottleware, sampling supplies (including coolers, temperature blanks, and control waters), and associated supporting documentation, such as labels, chain-of-custody (COC) forms, etc. will be shipped to the following address: Golder & Associates, c/o Possum Point Power Station; Possum Point Warehouse; 19000 Possum Point Road; Dumfries, VA 22026. Site personnel will pick up the deliveries at the site unless otherwise arranged with the Station in advance. Qualified samplers will be responsible for completing the bottle labels and relevant information on the chain-of-custody forms. Additionally, the sampling activities will be coordinated with Dominion representatives, as required. Example templates for field notes to document sample event data are provided in Appendix B.***

**The proposed schedule for compliance monitoring is provided in Table 4.**

**Table 4**  
**Proposed Schedule for Compliance Monitoring at Internal Outfall 503**

<b>Day of Week<sup>1</sup></b>	<b>Sample Events<sup>2,3</sup></b>
<b>Sunday</b>	<b>Flow Estimate</b>
	<b>3/W 4H-C for Metals/Oils and Grease</b>
	<b>3/W Grab for pH</b>
	<b>1/M 4H-C for remaining Metals</b>
	<b>1/M 24H-C for Acute Toxicity</b>
	<b>1/M 24H-C for Chronic Toxicity (Day 1)</b>
<b>Tuesday</b>	<b>Flow Estimate</b>
	<b>3/W 4H-C for Metals/Oils and Grease</b>
	<b>3/W Grab for pH</b>
	<b>1/M 24H-C for Chronic Toxicity (Day 2)</b>
<b>Thursday</b>	<b>Flow Estimate</b>
	<b>3/W 4H-C for Metals/Oils and Grease</b>
	<b>3/W Grab for pH</b>
	<b>1/M 24H-C for Chronic Toxicity (Day 3)</b>

**Notes:**

- <sup>1</sup> **The days of the week specified are not necessarily the days of the week that the samples are collected. As long as the 3/W 4H-C samples are collected between Sunday and Saturday and are collected 48 hours apart, the requirements in footnote 5 and definition 4H-C of Table A.3. of the VPDES Permit (VA0002071) will be satisfied.**
- <sup>2</sup> **Frequency Definitions:**
  - a. **3/W = three days per week.**
  - b. **4H-C = four-hour flow proportional composite sample.**
  - c. **Grab = an individual sample over a period of time not to exceed 15 minutes.**
  - d. **1/M = Once per month.**
  - e. **24H-C = 24-hour flow proportional composite sample.**
  - f. **Estimate = Reported flow based on technical evaluation of sources belonging to the discharge.**
  - g. **Three days of samples are required for each Chronic Toxicity test.**
- <sup>3</sup> **The composite period for the parameters identified with a monitoring frequency of "1/M" shall occur within the composite period for the Whole Effluent Toxicity monitoring.**

**When there are pauses in discharge that last more than two days, less than three weekly samples may be collected, as it might not be possible to collect three weekly samples with the 48-hour required timespan between collections. In these cases, the proposed sample collection schedule in Table 4 will be altered per Dominion's direction.**

## 5.1 Grab Samples

A smooth-nosed sample tap is proposed to collect and analyze Internal Outfall 503 grab samples for pH (refer to Drawing C150132-00-050-00-P-B2-001 "Sheet 1: Flow Paced Sampler Plumbing Schematic" for location). This sample tap will be used to collect grab samples and deliver them to the lab for analysis. ***All grab samples for pH analysis will be analyzed by sampling personnel per method SM21 4500-H<sup>+</sup>, per DEQ guidance within the required 15-minute hold time.***

## 5.2 Flow Proportional Composite Samples

### 5.2.1 Automatic Collection

Four ISCO 6712FR refrigerated flow paced samplers will be used at Internal Outfall 503 (Interim/Final) to collect 4-hour and 24-hour flow proportional composite samples (Refer to attached DRAWINGS). Each flow paced sampler is equipped with a single 5.3-gallon wide mouth, opened top glass container to collect flow paced sample aliquots. A high flowrate Watson-Marlow 720N peristaltic pump will be installed to feed Internal Outfall 503 discharges to a ¾-inch manifold for the four samplers. A one-half-inch inner diameter suction line will connect the ¾-inch manifold to each of the four flow paced samplers. Refer to Appendices C, D, and E for more information regarding the flow paced samplers.

A Greyline clamp-on Transit Time Flow Meter (TTFM) Model 1.0 is proposed to measure Internal Outfall 503 discharges. The TTFM can relay a 4 - 20 mA (0 - 5 V) signal representing the totalized flow at Internal Outfall 503. The flow paced samplers will be programmed to collect an aliquot for a pre-set volume of flow through Internal Outfall 503. Refer to Appendices F and G for more information regarding the meter.

***A peristaltic pump with disposable tubing will be available to fill the sample bottles from the 5.3-gallon automatic sampler container.*** Sample bottles will be filled per lab requirements (*i.e., half of the hexavalent chromium bottle is to be filled for proper sample preservation*) in the COC forms and placed in coolers on ice. ***Custody of the coolers containing samples will be signed over to the courier, which will deliver the samples to the offsite lab for analysis, or via a third party courier for delivery to the toxicity laboratory, as applicable.*** Following each sample event, the remaining collected waters in the flow paced sampler containers must be disposed, sampler containers must be decontaminated, and the used sampler tubing/couplers must be replaced (as detailed in Section 5.3).

The recommended power source for each of the refrigerated samplers is a designated 20-amp circuit. Flow paced samplers will be housed in a ***refrigerated*** enclosure in order to maintain a clean, temperature-controlled sampling environment, as shown in the attached ***Flow Paced Sampler Plumbing Schematic, Sheet 1 and Details, Sheet 2. NIST-traceable thermometers will be used to monitor the temperatures of the automated samplers. The temperatures will be monitored (and verified with a secondary NIST-traceable thermometer) on a daily basis. All readings will be recorded in the appropriate log and maintained onsite. Per VA DEQ guidance, all thermometers will be re-calibrated or will be replaced prior to the expiration date on the NIST documentation.***

Guidance documents on how to install the flow paced samplers, install the suction line, program the sampler, etc. are in Appendices D and E.



### 5.2.2 Manual Collection

Manual flow proportional composite samples will be required should the flow paced samplers fail. In such an event grab samples will be collected hourly per the Permit (Refer to Appendix A for manual flow proportional composite sampling requirements), and at the discharge of the temporary storage for the treatment system.

Collected aliquots for manual flow proportional composite sampling will be collected at a sample tap in two half-gallon glass containers (for 4-hour duration events, i.e., for metals, pH, TSS, O&G) or one half-gallon plastic containers (for 24-hour duration events, i.e., for acute and chronic toxicity). A glass beaker/graduated cylinder will be used to apportion each aliquot to a 5.3-gallon, glass ISCO sampler container for blending the composite sample. For apportioning a collected aliquot to the composite sample, the amount will be based on the totalized flow through Internal Outfall 503 over each hour that precedes aliquot collection. However, should the instantaneous flow through Internal Outfall 503 not vary by 10 percent or more anytime during sampling event, aliquots will be apportioned to the composite sample equally.

### 5.2.3 Quality Assurance Samples

***Sampling blanks, including equipment and field blanks, will be collected at defined intervals to assess the decontamination of each flow paced sampler equipment and quality of the sampling environment, respectively. Equipment blank samples will be collected in order to identify the effectiveness of decontamination procedures. Equipment blank samples will be collected by passing either DI water or laboratory-provided control water (for toxicity analyses), as applicable, over and/or through the decontaminated reusable sampling equipment (i.e., collection bottles, beakers, etc.), and collecting this rinse water in sample containers for analysis. Laboratory control water consists of de-ionized (DI) water with added Ca, Mg, K, Cl, Na, sulfate, and bicarbonates per EPA requirements for moderately hard standard synthetic freshwater. Laboratory control water for acute and chronic toxicity equipment/field blanks will be ordered from the toxicity laboratory and shipped the day prior to the sampling event as the control water should not be stored for long periods of time. DI water utilized for the collection of all other blank samples will either be purchased if not collected at the onsite laboratory's DI water system that is installed onsite.***

***Field blank samples will be collected in order to assess contamination from the sampling environment. These samples will be prepared by filling open top sample bottles with DI water or laboratory-provided control water (for toxicity analyses), as applicable, at the start of a flow proportional composite sampling event. The samples will be placed inside the ISCO sampler refrigerators used to collect primary samples. When all compliance monitoring samples have been collected at the end of the sampling event, and sample bottles to be submitted to the lab have been secured, the field blank sample containers will be secured and placed in the respective shipping coolers on ice. The collection frequency of the field and equipment blanks are specified in Table 5.***

**Table 5**  
**Field-Collected QA/QC Sample Frequency**

<b>Parameter</b>	<b>Frequency</b>	<b>Comments</b>
<b>Oil and Grease</b>	<b>Once per Week</b>	<b>DI Water</b>
<b>Metals</b>	<b>Once every 2 Weeks</b>	<b>DI Water</b>
<b>Hardness</b>		<b>DI Water</b>
<b>Chloride</b>		<b>DI Water</b>
<b>TSS</b>		<b>DI Water</b>
<b>Acute Toxicity</b>	<b>Once every 2 Months</b>	<b>Laboratory-provided Control Water</b>
<b>Chronic Toxicity</b>	<b>Once every 6 Months</b>	<b>Laboratory-provided Control Water</b>

**Laboratory control water will be provided by the toxicity laboratory for toxicity blank sample analysis, and DI water will be collected at the onsite DI water system as previously discussed in the equipment blank procedures paragraph above.**

### 5.3 Decontamination of Sampling Equipment

Following **the collection of the required samples**, flow paced sampler containers will be emptied of excess collected waters. A portable peristaltic pump will be used to empty flow paced sampler containers into designated 5-gallon portable "Carboys" for **excess sample water**. The excess collected waters will be disposed of at either the holding tank for the onsite mobile lab or at the head of the treatment system for Internal Outfall 503 discharges. Flow paced sampler 5.3-gallon glass containers **and all other reusable equipment** can then be decontaminated using the following procedure, consistent with VA DEQ Water Quality Monitoring Standard Operating Procedures, to be carried out in sequence:

- **rinse equipment with Tap or DI water**
- wash **reusable equipment** with lab grade soap solution (Liquinox or Alconox and DI water) using a brush to remove particulate matter or surface film.
- rinse with DI water<sup>1</sup> **a minimum of** three times.
- **allow reusable equipment** to air-dry **within the ISCO sampler refrigerators**.
- if flow paced sampler containers have rust stains or other hardened deposits, use a paste made of baking soda and water to scour the deposits using a soft brush or clean cloth. After cleaning, repeat the above steps.
- **non-metallic reusable equipment** should also be rinsed with nitric acid on an infrequent basis, at least once per month, which is generally used as a rinse when metals are constituents of concern. **Dispose of nitric acid in the designated decontamination waste container and rinse the reusable equipment with DI water (suggest a minimum of three times).**
- the decontamination wastewaters (i.e., soap solution, tap water, and DI water) will similarly be emptied from the flow paced sampler containers, except in designated five-gallon portable "Carboys" for decontamination wastewaters, and disposed of exclusively at the holding tank for the onsite mobile lab.

<sup>1</sup> As mentioned previously, DI water will be purchased by **sampling** staff or collected at the mobile laboratory.



Flow paced sampler suction/pump head tubing and couplings will be replaced after each sampling event. ***In the event of a pause in flow and the decision is made to restart sampling, all reusable equipment must be decontaminated, and all disposable equipment must be replaced prior to the collection of the new samples.*** Tubing for the portable peristaltic pump used to fill lab bottles with water from flow paced sampler containers will also require replacement after each sampling event. Replacement parts will be provided onsite so that at least one month's supply are in-stock onsite at all times. Tubing Stock and Reorder Information is identified in **Table 6**. Sheet 1 in the Drawings also details the replacement materials/part numbers.

**Table 6**  
**Tubing Stock and Reorder Information**

Stock Item	Part Number	Quantity	Estimated One-Month Usage
High Flow Peristaltic Pump Marprene Tubing, 1-inch I.D.	Watson-Marlow Part No. 902.0254.048	Rolls of 50 Linear Feet	Rotate tubing six inches along pump head each week; one 50-foot roll of tubing should last approximately four months
Sampler Vinyl Suction Tubing, ½-inch I.D.	Teledyne ISCO Part No. 68-1680-059	Rolls of 500 Linear Feet	90 Linear Feet
PTFE Sampler Tubing Coupling, 3/8-inch I.D.	Teledyne ISCO Part No. 60-3709-002	Pack of 28 Couplings	30 Couplings
Sampler Pump Banded Silicon Tubing, 3/8-inch I.D.	Teledyne ISCO Part No. 60-6700-045	Pack of 25 Sections of Tubing	30 Sections of Tubing
Portable Peristaltic Pump Marprene Tubing, ¼-inch I.D.	Watson-Marlow Part No. 902.0064.024	Rolls of 50 Linear Feet	150 Linear Feet

## 5.4 Preventative Maintenance

The high flow rate peristaltic pump that feeds the manifold for the flow paced samplers should be observed for operation regularly (i.e., during each sample event). If the lead pump is off/not operating correctly and the lag pump is on, a replacement pump will need to be purchased as soon as practical. Similarly, should a portable peristaltic pump be not operating correctly, a replacement pump would need to be purchased.

Marprene tubing for the high flow rate peristaltic pump will be moved along the pump head in 6 inch increments each week and replaced prior to being used up. Tubing Stock and Reorder Information is shown in **Table 6**.

## 5.5 Investigative-Derived Materials Plan

In the process of collecting environmental samples during the sampling events, the sampling team will generate different types of potentially contaminated materials. **Investigative**-derived materials (IDM) may include, but not be limited to, the following:

- used personal protective equipment (PPE);
- disposable sampling equipment;
- flow paced sampler container decontamination wastewaters; and
- excess collected flow paced sampling waters.

Decontamination wastewaters will be collected in labeled 5-gallon carboys and discharged to a waste holding tank onsite maintained by the mobile **lab**, as discussed in Section 5.3. The waste holding tank will be pumped out and/or sent offsite for treatment and disposal. Excess sampling waters will be

collected in labeled 5-gallon carboys and discharged to the waste holding tank onsite maintained by the mobile **lab** or alternately to the head of the treatment system for Internal Outfall 503 discharges. Decontamination wastewaters and excess collected flow paced sampling waters shall not be intermingled, given the potential for separate disposal locations. All other IDM will be collected in heavy duty trash bags. **This** waste **is** not considered hazardous **and therefore** can be disposed of in a **municipal** landfill.

## 5.6 Sample Handling and Custody

Field personnel responsibilities include, but are not limited to, the following:

- collecting and placing all samples for laboratory analysis in the appropriate sample containers at the site;
- labeling the sample bottles appropriately;
- **using the pH meter to analyze for pH in accordance with SM21 4500-H<sup>+</sup> and applicable DEQ guidance;**
- using preservatives, as required;
- packing sample bottles to prevent breakage and leakage of their contents within coolers/ice;
- delivering samples to the laboratory under proper COC;
- decontaminating sampling equipment; and
- documenting sampling events and procedures followed.

Records concerning the custody and condition of the samples are maintained in field and laboratory records. Sample custody will be the responsibility of the designated field personnel from the time of sample collection until delivery of the samples to the **sample courier or** analytical laboratories, **as applicable**. Thereafter, custody will be maintained by the analytical laboratory performing the analysis.

### 5.6.1 Sample Documentation

Field logbooks will be used to document where, when, how, and from whom any vital project information was obtained in the field. Logbook entries should be complete and accurate enough to permit reconstruction of field activities and should include documentation of any anomalous situations and deviations from the plan, and field screening measurements. Logbooks will have consecutively numbered pages. All field logbook entries should be legible, written in indelible ink, and signed by the individual making the entries. Factual, objective language will be used, and any corrections to the field logbook will follow the error correction protocol of one line through the error, the initials of the person performing the correction, and the date of the correction.

At a minimum, the following information will be recorded during each sampling event:

- ▶ team members onsite;
- ▶ time of arrival onsite;
- ▶ summary of any meetings with onsite personnel, including contractors;
- ▶ deviations from workplans, and/or sampling plans;
- ▶ levels of safety protection;
- ▶ sample location, description, and ID (**refer to daily job safety analysis for details**);

- ▶ sampler's name(s);
- ▶ date and time of sample collection;
- ▶ designation of sample as composite or grab;
- ▶ field instrument readings and calibration (if applicable); **and**
- ▶ field observations and details related to analysis or integrity of samples (e.g. weather conditions, noticeable odors, colors, etc.).

The information included in Appendix B, "Field Report Templates for Compliance Monitoring" shall be included in the bound field logbooks used for official documentation of field activities.

**Table 7 identifies sample container specifications, preservation requirements, and hold times for the methods utilized to analyze the samples for the constituents required in the VPDES permit.**

### 5.6.2 Sample Container Preparation and Labeling

Sample containers with sample preservative, if needed, will be ordered from the laboratory before sampling events. Sample Labels will contain the following information:

- ▶ **unique sample identification number;**
- ▶ **date of collection;**
- ▶ **time of collection;**
- ▶ **sampler's initials;**
- ▶ **analysis(es) to be performed;** and
- ▶ **preservation,** or "none" as applicable.

In order to maintain consistency, each sample will be assigned a sample identification number using a standard format, based on the outfall and sample number or date, and whether or not the sample is a grab or composite sample with the following convention:

#### **Primary Samples:**

**LLL-F-#HR-MM-DD-YY**

**Where:**

**F = frequency of collection 1/M (once per month) or 3/W (three times per week)**

**#HR = 4-HR or 24-HR composite sample**

**MM = Month**

**DD = Day**

**YY = Year**

#### **Blank Samples:**

**LLL-#G-MM-DD-YY**

**Where:**

**LLL = sampling location (i.e., 503)**

**#G = 1G (field blank) or 2G (equipment blank)**

**MM = Month**

**DD = Day**

**YY = Year**

#### **Backup Samples:**

**LLL-F-#HR-MM-DD-YY-R2**

**Where:**

**LLL = sampling location (i.e., 503)**  
**#HR = 4-HR composite sample**  
**MM = Month**  
**DD = Day**  
**YY = Year**  
**R2 = sample set #2 for backup purposes**

**Table 7**  
**Parameters for Analysis**

<b>Constituent</b>	<b>Number of Bottles per Sample ID<sup>1</sup></b>	<b>Preservation<sup>1</sup></b>	<b>Hold Time<sup>1</sup></b>	<b>Analytical Method<sup>1</sup></b>
<b>Flow (MGD)</b>	<b>N/A<sup>2</sup></b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>
<b>pH (Field measurement)</b>			<b>15 Minutes</b>	<b>SM21 4500-H<sup>+</sup></b>
<b>Total Suspended Solids</b>	<b>(2) - 1 L plastic</b>	<b>&gt; 0 °C to 6 °C</b>	<b>7 Days</b>	<b>SM 2540D</b>
<b>Oil and Grease</b>	<b>(3) - 1 L glass amber</b>	<b>&gt; 0 °C to 6 °C HCl</b>	<b>28 Days</b>	<b>EPA 1664B</b>
<b>Aluminum, Total</b>	<b>(3) - 250 mL plastic</b>	<b>&gt; 0 °C to 6 °C and HNO<sub>3</sub></b>	<b>6 Months</b>	<b>EPA 200.7</b>
<b>Aluminum, Dissolved</b>				<b>EPA 200.7</b>
<b>Antimony, Total</b>				<b>EPA 200.8</b>
<b>Arsenic, Total</b>				<b>EPA 200.8</b>
<b>Barium, Total</b>				<b>EPA 200.7</b>
<b>Beryllium, Total</b>				<b>EPA 200.7</b>
<b>Beryllium, Dissolved</b>				<b>EPA 200.7</b>
<b>Boron, Total</b>				<b>EPA 200.7</b>
<b>Cadmium, Total</b>				<b>EPA 200.8</b>
<b>Chromium, Total<sup>β</sup></b>				<b>EPA 200.8</b>
<b>Cobalt, Total</b>				<b>EPA 200.7</b>
<b>Copper, Total</b>				<b>EPA 200.8</b>
<b>Iron, Total</b>				<b>EPA 200.7</b>
<b>Lead, Total</b>				<b>EPA 200.8</b>
<b>Molybdenum, Total</b>				<b>EPA 200.7</b>
<b>Nickel, Total</b>				<b>EPA 200.8</b>
<b>Selenium, Total</b>				<b>EPA 200.8</b>
<b>Silver, Total</b>				<b>EPA 200.8</b>
<b>Thallium, Total</b>				<b>EPA 200.8</b>
<b>Vanadium, Total</b>				<b>EPA 200.7</b>
<b>Zinc, Total</b>				<b>EPA 200.8</b>
<b>Hardness, Total (as CaCO<sub>3</sub>)</b>				<b>EPA 200.7</b>
<b>Mercury, Total</b>			<b>28 Days</b>	<b>EPA 245.1</b>
<b>Chloride</b>	<b>(1) - 250 mL plastic</b>	<b>&gt; 0 °C to 6 °C</b>	<b>28 Days</b>	<b>SM 4500-Cl-E</b>

**Table 7**  
**Parameters for Analysis**

<b>Constituent</b>	<b>Number of Bottles per Sample ID<sup>1</sup></b>	<b>Preservation<sup>1</sup></b>	<b>Hold Time<sup>1</sup></b>	<b>Analytical Method<sup>1</sup></b>
<b>Chromium VI, Total</b>	<b>(1) - 250 mL plastic</b>	<b>Ammonium Sulfate &amp; Ammonium Hydroxide &gt; 0 °C to 6 °C</b>	<b>14 Days</b>	<b>EPA 218.7</b>
<b>48-Hour Static Acute Toxicity Test using Ceriodaphnia dubia</b>	<b>(1) - 0.5-gallon plastic</b>	<b>&gt; 0 °C to 6 °C</b>	<b>36 Hours</b>	<b>40 CFR 136.3 EPA 2002.0</b>
<b>48-Hour Static Acute Toxicity Test using Pimephales promelas</b>				<b>40 CFR 136.3 EPA 2000.0</b>
<b>Chronic 3-Brood Static Renewal Survival and Reproduction Test using Ceriodaphnia dubia</b>	<b>(3-5) - 1-gallon plastic<sup>4, 5</sup></b>	<b>&gt; 0 °C to 6 °C</b>	<b>36 Hours</b>	<b>40 CFR 136.3 EPA 1002.0</b>
<b>Chronic Seven-Day Static Renewal Survival and Growth Test using Pimephales promelas</b>	<b>(3-5) - 1-gallon plastic</b>	<b>&gt; 0 °C to 6 °C</b>	<b>36 Hours</b>	<b>40 CFR 136.3 EPA 1000.0</b>

**Notes:**

- <sup>1</sup> **The bottle type and volume, preservation, hold time, and methods listed correspond to the current laboratory's methods and procedures. If the laboratory changes, the methods and procedures may be subject to change as well.**
- <sup>2</sup> **N/A = Not Applicable.**
- <sup>3</sup> **Total Chromium analysis is required to calculate Chromium III; although permit does not require monitoring/reporting of total Chromium.**
- <sup>4</sup> **Chronic Toxicity sample volumes in the table are for non-UV treated, compliance monitoring sample volumes only. Sample volumes required are: Monday (3 gal), Wednesday (3 gal), Friday (5 gal).**
- <sup>5</sup> **UV treated Chronic Toxicity sample volumes required are approximately: Monday (1 gal), Wednesday (1 gal), Friday (3 gal). UV treated samples will not be diluted and this is reflected in the said volumes.**

### 5.6.3 Sample Custody and Shipping

COC records will be maintained for all compliance monitoring and blank samples. Procedures to maintain the custody and integrity of the samples begin at the time of sampling and continue through transport, sample receipt, preparation, analysis and storage, data generation and reporting, and sample disposal. Records concerning the custody and condition of the samples are maintained in field and laboratory records.

COC forms are used to document sample collection and shipment to the laboratory for analysis. All samples will be accompanied by a completed and signed COC form. The following minimum information concerning the sample will be documented on a COC form:

- ▶ **unique sample identification;**
- ▶ **date and time of sample collection;**

- ▶ ***preservation used;***
- ▶ ***analysis required;***
- ▶ ***signature of sampler;*** and
- ▶ ***custody transfer signatures, dates, and times.***

Each person in custody of samples must sign his or her name and record the date and time of transfer on the COC form. Additionally, a copy of the COC will be made and supplied to both the field lead and the laboratory prior to shipment to the laboratory for analysis.

At the time of sample collection, all samples will be placed in insulated coolers for transport to the laboratory. The following outlines the packaging procedures that will be followed for shipped and couriered samples:

- ▶ ***samples*** will be maintained at refrigerated temperatures by the use of ice.
- ▶ ***where*** glass sample containers are utilized, bubble wrap will be used to prevent breakage during shipment.
- ▶ ***check*** screw caps for tightness and, if not full, mark the sample volume level of liquid samples on the outside of the samples with indelible ink.
- ▶ ***sample*** bottles will be placed in plastic bags provided by the laboratory and sealed appropriately.
- ▶ ***coolers*** will be sealed by tape, where applicable, and custody seals provided by the laboratory.

## 6.0 Analytical Testing Summary

***A grab sample will be collected for onsite pH analysis, and flow will be recorded from a flow meter. The offsite labs will analyze all constituents in Table 7. Table 8 compares all Quantification Levels (QL) required by the DEQ and the proposed laboratory Limits of Quantitation (LOQ). To identify potential pathogen influence on toxicity samples, a UV-treated and non-UV-treated sample will be analyzed in the lab for each toxicity test unless otherwise directed by Dominion. Note that the toxicity sample volumes in Table 7 are for a single non-UV-treated test.***

**Table 8**  
**QL Comparison - Parameters for Analysis**

Constituent	DEQ QL	Lab LOQ	Units	QL Achievable by Lab (Y/N)
Total Suspended Solids	1.0	1.0	mg/L	Yes
Antimony, Total	5.0	<b>5.0</b>	ug/L	Yes
Arsenic, Total	5.0	<b>5.0</b>	ug/L	Yes
Cadmium, Total	0.88	<b>0.88</b>	ug/L	Yes
Chromium III, Total	5.0	<b>5.0</b>	ug/L	Yes
Chromium VI, Total	5.0	<b>0.25</b>	ug/L	Yes
Copper, Total	5.0	<b>5.0</b>	ug/L	Yes
Lead, Total	5.0	<b>5.0</b>	ug/L	Yes
Mercury, Total	0.1	<b>0.10</b>	ug/L	Yes
Nickel, Total	5.0	<b>5.0</b>	ug/L	Yes
Selenium, Total	5.0	<b>5.0</b>	ug/L	Yes
Silver, Total	0.4	<b>0.40</b>	ug/L	Yes
Thallium, Total	0.47	<b>0.47</b>	ug/L	Yes
Zinc, Total	25	<b>25.0</b>	ug/L	Yes

Notes:

- <sup>1</sup> QL = Quantification Levels.
- <sup>2</sup> LOQ = Limit of Quantitation.
- <sup>3</sup> QL and LOQ are synonymous terms.



## 7.0 Quality Assurance/Quality Control of Sample Data

Laboratories **certified** by the Commonwealth of VA **will be utilized to analyze samples to demonstrate VPDES permit compliance. The toxicity lab will be** accredited by the National Environmental Laboratory Program. The Lab Reports will be reviewed with the laboratory quality assurance/quality control (QA/QC) limits specified in each applicable laboratory Standard Operating Procedure (SOP) as well as the National Functional Guidelines (NFG), where applicable. Quality parameters monitored include but are not limited to holding times, sample receipt temperatures, method blank comparisons, matrix spike recoveries, laboratory control sample recoveries, etc., where applicable. If the laboratory data fall outside the laboratory SOP-specified QA/QC limits, data will be qualified or rejected based on the NFGs and professional judgement, as deemed necessary. Sensitivity of sample data will be monitored through the comparison of DEQ-required QLs and the LOQs provided with laboratory data. Completeness of the data will be monitored for each laboratory deliverable. In order to maintain the comparability of data, sampling procedures described in Section 5.0 will be followed, and standard analysis methods will be utilized, as listed in **Table 7**. Unless specifically requested, formal validation of the laboratory data will not be conducted under this sampling plan. Data quality issues encountered will be documented in accordance with the permit and will be communicated to the client and Laboratory. Should a re-analysis of the respective constituents be required, such information will be communicated and requested by the laboratory immediately. Laboratories will be required to retain samples for a **minimum duration of** the hold times **for each respective analysis in Table 6** to allow for re-analysis.

## 8.0 Discharge Monitoring Reports

A Summary Report will be tabulated in Excel format for each sampling event. The Summary Report will include the analytical results, sampling dates, sampler name, estimated flow, field pH measurements, etc. A copy of the Laboratory Report and the Excel Summary Report will be submitted to Dominion by Tuesday of the week following sample collection; except under extenuating circumstances (e.g., weather-related delays, etc.). A copy of the Excel Summary Report is provided in Appendix H.

**The** data required for submitting the Monthly Electronic Discharge Monitoring Reports (eDMR's) **will be provided to Dominion**. The data will be provided on the attached hard copy DMR template with the certified signature of the lead sampler **or designee** by the 5<sup>th</sup> of each month (Refer to Appendix I). Dominion will submit the eDMR's to the DEQ in accordance with the conditions of the Permit.

## 9.0 Safety


At a minimum, **the** Client's safety requirements **will be satisfied**, including start of the day and shift change pre-job briefings **as well as JSA forms**.

**FIGURE**





GAI CAD FILE PATH: Z:\Energy\2015\20150132.00 - DOM - Possum Point PS CCB\Working Docs\Task 50 - Metals Analysis to Dewater Ash Ponds\Drawings\C150132.00-Site Plan.dwg

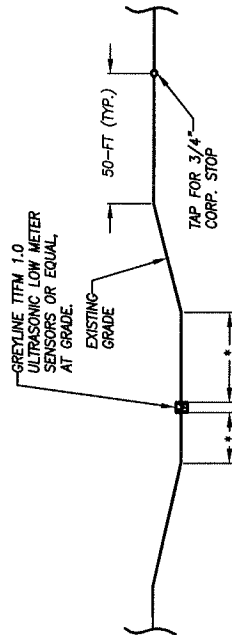
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SITE PLAN FOR INTERIM CONFIGURATION PHASE DURING CONSTRUCTION			VASKOAJ	DEBARJD	QUINLSC
PROJECT			DWG TYPE:	SCALE:	ISSUE DATE:
POSSUM POINT POWER STATION 19000 POSSUM POINT ROAD DUMFRIES, PRINCE WILLIAM COUNTY VIRGINIA 22026				1" = 700'	03/29/2016
			SHEET NO.: 1 OF 1		
			GAI FILE NUMBER: C150132.00-Site Plan		
			GAI DRAWING NUMBER: FIGURE 1		
This drawing was produced with computer aided drafting technology and is supported by electronic drawing files. Do not revise this drawing via manual drafting methods.					
ISSUING OFFICE: Richmond   4198 Cox Road, Suite 114, Glen Allen, VA 23060					
PLOTTED ON: 3/29/2016 8:40:28 PM PLOTTED BY: John DeBarbieri PLOT FILE: GAI.stb					

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## **DRAWINGS**







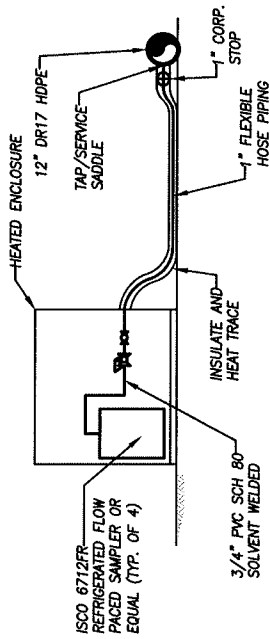
\*STRAIGHT PIPE PER MANUFACTURER (6 x DIA. UPSTREAM AND 10 x DIA. DOWNSTREAM TYPICAL).

- NOTES:
- METER SENSORS TO BE INSTALLED ON PIPE WITHIN METER VAULT. METER DATA LOGGER / ELECTRONICS ENCLOSURE TO BE MOUNTED INSIDE ENCLOSURE.

### SECTION B-B'

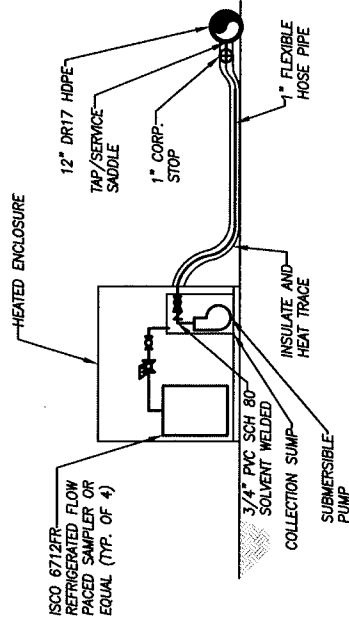
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CONSTRUCTION



### SECTION A-A'

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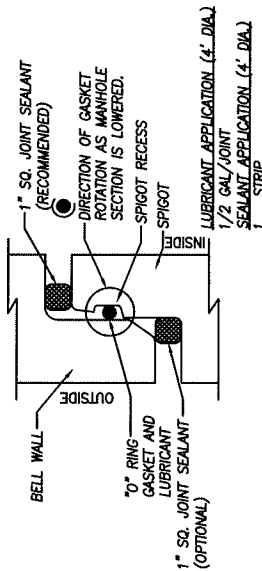
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N.T.S.

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PROJECT										CLIENT		AS SHOWN		04/1/2016	
POSSUM POINT POWER STATION										VIRGINIA ELECTRIC AND POWER COMPANY		SHEET NO.:		2 OF 2	
19000 POSSUM POINT ROAD										5000 DOMINION BOULEVARD		GAI FILE NUMBER:		C150132-00-050-00-P-B2-001_1	
DUMFRIES, PRINCE WILLIAM COUNTY										GLEN ALLEN, VIRGINIA 23060		GAI DRAWING NUMBER:		SHEET 2	
VIRGINIA 22026															
REVISION RECORD															
NO.:										DATE:		DWN:		CHK:	
1										04/18/2016		LENHARL		DEBARJ	
REVISIONS BASED ON DOMINION'S COMMENTS															
DESCRIPTION:										APV:					

FOR INFORMATIONAL  
PURPOSES - NOT FOR  
CONSTRUCTION

	FINISHED GRADE TO PIPE INVERT	
A	25'	
B	RESERVE CAPACITY	18"
C	OPERATION CAPACITY TO MINIMIZE SHORT CYCLING	18"
D	PUMP SUBMERGENCE	12"
E	TOTAL (ADD A THROUGH D + 8")	81"
F	FRAME & COVER & ADJUSTMENT (3" INCREMENTS)	7.5"
G	INSIDE HEIGHT OF MANHOLE	53.5"
H		

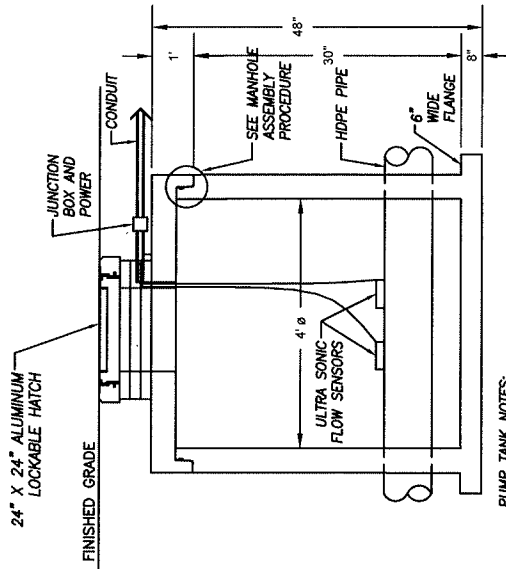


#### INSTALL INSTRUCTIONS:

1. CLEAN OUTSIDE OF MANHOLE SURFACE SPIGOT OF ALL FOREIGN MATERIAL & CHECK FOR IMPERFECTIONS WHICH MAY RESTRICT "O" RING ROTATION.
2. LUBRICATE MANHOLE SPIGOT LIBERALLY BEFORE "O" RING IS INSTALLED.
3. LUBRICATE "O" RING BEFORE INSTALLING INTO SPIGOT RECESS.
4. STRETCH "O" RING GASKET OR SIMILAR TOOL UNDER THE GASKET, TRAVELING THE TOTAL MANHOLE CIRCUMFERENCE. (MAKE CERTAIN "O" RING GASKET IS HELD AT THE TOP OF SPIGOT RECESS).
5. CLEAN & LUBRICATE THOROUGHLY INSIDE SURFACE OF BELL.
6. ALIGN SPIGOT & BELL AND COUPLE MANHOLE SECTIONS.
- A. MANHOLE SECTIONS SHOULD BE INSTALLED WITH PROPER LIFTING APPARATUS, STRONGBACK OR EQUAL, SUCH THAT MANHOLE SECTIONS WILL HANG FREE & LEVEL.
- B. SECTIONS SHOULD BE LOWERED TO A POINT WHERE TAPER OF INSIDE BELL IS IN CONTACT WITH "O" RING THE TOTAL CIRCUMFERENCE OF MANHOLE SECTION.
- C. LOWER SECTION EVENLY UNTIL SECTIONS SEAT.

#### ADDITIONAL NOTES:

1. A TAR JOINT MUST BE APPLIED TO ALL MANHOLES.
2. EQUIPMENT MUST NEVER BE USED TO FORCE MANHOLE SECTIONS TOGETHER. IF DIFFICULTY IS ENCOUNTERED, REMOVE SECTION AND REPEAT STEPS 1-6. CALL KISTNER'S SALES & ENGINEERING DEPARTMENT IMMEDIATELY.
3. "O" RING GASKET ACTUALLY SPINS AS TOP SECTION IS LOWERED. FOR THIS REASON LUBRICATION IS NECESSARY FOR SUCCESSFUL INSTALLATION. IF "O" RING GASKET IS RESTRICTED AND IS NOT ALLOWED TO SPIN FREELY, THIS WILL ULTIMATELY CAUSE THE GASKET TO PINCH, RESULTING WITH UNEQUAL PRESSURE UPON BELL WALL THUS CAUSING RUPTURE. (SEE RECOMMENDED LUBRICANT USAGE FROM CHART LISTED ABOVE).
4. IN COLD WEATHER, GASKETS MUST BE KEPT IN A WARM ENVIRONMENT, OR THE COLD HARDENED GASKET WILL POSSIBLY CAUSE RUPTURING OF THE BELL WALL.
5. SEALANT APPLICATION SHALL BE PER POINT OF APPLICATION (MANUFACTURER RECOMMENDS TWO APPLICATION POINTS PER JOINT AS SHOWN IN DETAIL).



#### PUMP TANK NOTES:

1. GASKETS ONLY FOR 4' DIA. (NO LUBE OR BUTYL REQ'D)
2. 2-PIPE OPENINGS REQUIRE WATERTIGHT SEALS.

### MANHOLE ASSEMBLY PROCEDURE

NS

### METER VAULT DETAIL

NS

DRAWING TITLE		DRAWN BY: DEBARJUD		CHECKED BY: DEBARJUD		APPROVED BY: DEBARJUD	
PROJECT		REVISION		SCALE: 03/29/2016		ISSUE DATE: 03/29/2016	
POSSUM POINT POWER STATION 19000 POSSUM POINT ROAD DUMFRIES, PRINCE WILLIAM COUNTY VIRGINIA 22026		CLIENT		AS SHOWN		SHEET NO.: 3 OF 3	
gai consultants		VIRGINIA ELECTRIC AND POWER COMPANY		GAI FILE NUMBER:		GAI DRAWING NUMBER:	
5000 DOMINION BOULEVARD GLEN ALLEN, VIRGINIA 23060		C150132-00-050-00-P-B2-001		SHEET 3		© 2016 GAI Consultants	
This drawing was produced with computer aided drafting technology and is supported by electronic drawing files. Do not revise this drawing via manual drafting methods.							
ISSUING OFFICE: Richmond J 4198 Cox Road, Suite 114, Glen Allen, VA 23060							
GAI CAD FILE PATH: Z:\Energy\2015\C150132\00 - DOW - Possum Point PS C&W\Working Docs\Task 50 - Metals Analysis to Dewater Ash Ponds\Drawings\C150132-00-050-00-P-B2-001.dwg							



## **APPENDIX A**

### **Outfall 503 (Interim/Final) Final Permit Discharge Monitoring/Limits**

**A. Effluent Limitations and Monitoring Requirements**

**13. Internal Outfall 503 – (Comingled Process Water, Ash Dewatering Water, Contact Water (Interim) / Ash Pond D Underdrain / Outfall 010 / Internal Outfall 501 (Final)) – When Routed to Outfall 001/002 or Outfall 004**

- a. There shall be no discharge of floating solids or visible foam in other than trace amounts.
- b. During the period beginning with the commencement of facility dewatering activities and lasting until the completion of dewatering and/or installation of the underdrain, or the expiration date, whichever occurs first, the permittee is authorized to discharge from Internal Outfall Number 503. The limitations below are applicable when the discharge from Internal Outfall 503 is routed to Outfall 001/002 or Outfall 004. Such discharges shall be limited and monitored by the permittee as specified below.

Parameter	Discharge Limitations				Monitoring Requirements <sup>(5,6)</sup>	
	Monthly Average <sup>(1,7)</sup>	Daily Maximum <sup>(1,7)</sup>	Minimum <sup>(7)</sup>	Maximum <sup>(1,7)</sup>	Frequency	Sample Type
Flow <sup>(2)</sup> (MGD)	NA	NA	NA	2.88	3/W	Estimate
pH	NA	NA	6.0 S.U.	9.0 S.U.	3/W	Grab
Total Suspended Solids (TSS) <sup>(4)</sup>	30 mg/L	100 mg/L	NA	NA	3/W	4H-C
Oil and Grease (O&G)	15 mg/L	20 mg/L	NA	NA	3/W	4H-C
Aluminum, Dissolved	NL (µg/L)	NL (µg/L)	NA	NA	1/M	4H-C
Antimony, Total Recoverable <sup>(4)</sup>	1300 µg/L	1300 µg/L	NA	NA	3/W	4H-C
Arsenic, Total Recoverable <sup>(4)</sup>	240 µg/L	440 µg/L	NA	NA	3/W	4H-C
Barium, Total Recoverable	NL (µg/L)	NL (µg/L)	NA	NA	1/M	4H-C
Beryllium, Dissolved	NL (µg/L)	NL (µg/L)	NA	NA	1/M	4H-C
Boron, Total Recoverable	NL (µg/L)	NL (µg/L)	NA	NA	1/M	4H-C
Cadmium, Total Recoverable <sup>(4)</sup>	1.4 µg/L	2.6 µg/L	NA	NA	3/W	4H-C
Chloride	370,000 µg/L	670,000 µg/L	NA	NA	3/W	4H-C
Chromium III, Total Recoverable <sup>(4)</sup>	88 µg/L	160 µg/L	NA	NA	3/W	4H-C
Chromium VI, Total Recoverable <sup>(4)</sup>	17 µg/L	32 µg/L	NA	NA	3/W	4H-C
Cobalt, Total Recoverable	NL (µg/L)	NL (µg/L)	NA	NA	1/M	4H-C
Copper, Total Recoverable <sup>(4)</sup>	9.6 µg/L	18 µg/L	NA	NA	3/W	4H-C
Iron, Total Recoverable	NL (µg/L)	NL (µg/L)	NA	NA	1/M	4H-C
Lead, Total Recoverable <sup>(4)</sup>	14 µg/L	26 µg/L	NA	NA	3/W	4H-C
Mercury, Total Recoverable <sup>(4)</sup>	1.2 µg/L	2.2 µg/L	NA	NA	3/W	4H-C
Molybdenum, Total Recoverable	NL (µg/L)	NL (µg/L)	NA	NA	1/M	4H-C
Nickel, Total Recoverable <sup>(4)</sup>	24 µg/L	44 µg/L	NA	NA	3/W	4H-C
Selenium, Total Recoverable <sup>(4)</sup>	8.0 µg/L	15 µg/L	NA	NA	3/W	4H-C
Silver, Total Recoverable <sup>(4)</sup>	2.2 µg/L	4.0 µg/L	NA	NA	3/W	4H-C
Thallium, Total Recoverable <sup>(4)</sup>	0.94 µg/L	0.94 µg/L	NA	NA	3/W	4H-C
Vanadium, Total Recoverable	NL (µg/L)	NL (µg/L)	NA	NA	1/M	4H-C
Zinc, Total Recoverable <sup>(4)</sup>	98 µg/L	180 µg/L	NA	NA	3/W	4H-C
Hardness, Total (as CaCO <sub>3</sub> )	NL (mg/L)	NL (mg/L)	NA	NA	3/W	4H-C
Acute Toxicity – <i>C. dubia</i> (NOAEC) <sup>(3)</sup>	NA	NA	100%	NA	1/M	24H-C
Acute Toxicity – <i>P. promelas</i> (NOAEC) <sup>(3)</sup>	NA	NA	100%	NA	1/M	24H-C
Chronic Toxicity – <i>C. dubia</i> (TU <sub>c</sub> ) <sup>(3)</sup>	NA	NA	NA	2.85 TU <sub>c</sub>	1/M	24H-C
Chronic Toxicity – <i>P. promelas</i> (TU <sub>c</sub> ) <sup>(3)</sup>	NA	NA	NA	2.85 TU <sub>c</sub>	1/M	24H-C

**A. Effluent Limitations and Monitoring Requirements**

**13. Internal Outfall 503 – (Comingled Process Water, Ash Dewatering Water, Contact Water (Interim) / Ash Pond D Underdrain / Outfall 010 / Internal Outfall 501 (Final)) – When Routed to Outfall 001/002 or Outfall 004 – Continued**

- (1) See Part I.B. MGD = Million gallons per day. 3/W = Three days per week.  
(2) Average flow is 2.53 MGD; Maximum flow is 2.88 MGD NA = Not applicable. 1/M = Once every month.  
(3) See Part I.C for whole effluent toxicity requirements. NL = No limit; monitor and report.  
(4) The following Quantification Levels (QLs) are applicable: TSS – 1.0 mg/L; S.U. = Standard units.  
Antimony – 5.0 µg/L; Arsenic – 5.0 µg/L; Cadmium – 0.88 µg/L; Chromium III – 5.0 µg/L; Chromium VI – 5.0 µg/L; Copper – 5.0 µg/L; Lead – 5.0 µg/L; Mercury – 0.1 µg/L; Nickel – 5.0 µg/L; Selenium – 5.0 µg/L; Silver – 0.4 µg/L; Thallium – 0.47 µg/L; Zinc – 25 µg/L. The permittee may provide documentation that demonstrates the QLs listed for Cadmium and Thallium are not achievable. Based upon review of this documentation the Department may establish higher QLs for Cadmium and Thallium in accordance with 40 CFR 122.44(i)(1)(iv).  
(5) Sampling for the parameters identified with a monitoring frequency of “3/W” for Internal Outfall 503 shall occur at least three (3) days per week with a minimum of 48 hours between sampling events. A sampling week extends Sunday through Saturday. The permittee shall contract to receive results for parameters identified with a monitoring frequency of “3/W” within four business days of taking the sample. Results of the weekly sampling shall be reported to DEQ no later than the close of business Friday of the week following sample collection. This reporting requirement does not substitute for, or alter, Part II.C concerning the monthly reporting of monitoring results with the Discharge Monitoring Report.  
(6) The composite period for the parameters identified with a monitoring frequency of “1/M” shall occur within the composite period for the Whole Effluent Toxicity monitoring.  
(7) The permittee shall immediately cease the discharge upon becoming aware of an exceedance of an established effluent limit and/or WET limit at Internal Outfall 503. See Part I.F.20 for additional requirements.

Grab = An individual sample collected over a period of time not to exceed 15-minutes.

Estimate = Reported flow is to be based on the technical evaluation of the sources contributing to the discharge.

**Metals and Total Hardness Requirements:**

Samples for all metals and total hardness shall be collected concurrently.

4H-C= A flow proportional composite sample collected manually or automatically, and discretely or continuously, for the entire discharge of the monitored 4 (four)-hour period. Where discrete sampling is employed, the permittee shall collect a minimum of 4 (four) aliquots for compositing. Discrete sampling may be flow proportioned either by varying the time interval between each aliquot or the volume of each aliquot. Time composite samples consisting of a minimum 4 (four) grab samples obtained at hourly or smaller intervals may be collected where the permittee demonstrates that the discharge flow rate (gallons per minute) does not vary by  $\geq 10\%$  or more during the monitored discharge.

24H-C= A flow proportional composite sample collected manually or automatically, and discretely or continuously, for the entire discharge of the monitored 24 (twenty-four)-hour period. Where discrete sampling is employed, the permittee shall collect a minimum of 24 (twenty-four) aliquots for compositing. Discrete sampling may be flow proportioned either by varying the time interval between each aliquot or the volume of each aliquot. Time composite samples consisting of a minimum 24 (twenty-four) grab samples obtained at hourly or smaller intervals may be collected where the permittee demonstrates that the discharge flow rate (gallons per minute) does not vary by  $\geq 10\%$  or more during the monitored discharge.

## **APPENDIX B**

### **Field Report Templates for Compliance Monitoring**



## Internal Outfall 503 4-HR Proportional Composite Sample Event Field Notes, Rev2

Date Range:

Virginia Electric and Power Company  
Possum Point Power Station  
Coal Combustion Residual Surface Impoundment Closures  
Dumfries, Virginia

GAI Project Number: C150132.00, Task 065

August 2016



**Dominion**<sup>SM</sup>

Prepared by: GAI Consultants, Inc.  
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4198 Cox Road, Suite 114  
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Prepared for: Virginia Electric and Power Company  
5000 Dominion Boulevard  
Glen Allen, Virginia 23060-3308

00014233

# INTERNAL OUTFALL 503 4-HR FLOW PROPORTIONAL COMPOSITE SAMPLE EVENT FIELD NOTES

Sample Event Date & Time (MM-DD-YY XX:XX AM/PM to XX:XX AM/PM):		
Full Name of GAI Sampler:		
Full Name(s) of Other GAI Personnel Present with Sampler (if applicable):		
Dominion/Other Personnel Present with Sampler:		
Weather Conditions:		
Summary of Significant/Noteworthy Events From Sample Event Period:		
<b>Pre-Sample Event Requirements</b>		
DI Water Carboy Filled?	Select	
Leftover Sample Water Disposed of at the Head of the Treatment System?	Select	
Decontamination Waste Disposed per Dominion Direction?	Select	
Monitoring Requirements:	<input type="checkbox"/> 3/Week Flow Estimate (MGD) <input type="checkbox"/> 3/Week pH Grab Sample <input type="checkbox"/> 3/Week Composite Constituent Analyses: TSS; Oil & Grease; Antimony, Total; Arsenic, Total; Cadmium, Total; Chloride; Chromium III, Total; Chromium VI, Total; Copper, Total; Lead, Total; Mercury, Total; Nickel, Total; Selenium, Total; Silver, Total; Thallium, Total; Zinc, Total; Hardness, Total as (CaCO <sub>3</sub> ) <input type="checkbox"/> 1/Month Composite Constituent Analyses: Aluminum, Total; Aluminum, Dissolved; Barium, Total; Beryllium, Total; Beryllium, Dissolved; Boron, Total; Cobalt, Total; Iron, Total; Molybdenum, Total; Vanadium, Total	
Date/Time of Previous Grab Sample (MM-DD-YY XX:XX AM/PM)		
Expected Pump Discharge Rate for Sampling Duration (GPM):		<input type="checkbox"/> Confirmed with contractor/treatment system operator
# of pulses between aliquot collections: <b>(Fill in expected flow and % discharge)</b> (1 pulse = 1,000 Gallons) $\text{Expected Pump Discharge Rate (GPM)} \times \frac{60\text{min}}{1\text{hr}} \times \frac{4\text{hrs}}{\text{Sampling Period}} \times \frac{1\text{ pulse}}{1000\text{ Gallons}} \times \frac{1\text{ Sampling Period}}{12\text{ aliquots}}$ $= \frac{\text{pulses}}{\text{aliquot}}$ $\text{Expected Pump Discharge Rate (GPM)} \times 0.02 = \frac{\text{pulses}}{\text{aliquot}}$		
Note: Round up calculated pulses/aliquot to the nearest whole number. Volume per aliquot (mL): $\frac{5.3\text{ Gallons for full ISCO Sample}}{12\text{ aliquots}} \times \frac{3785.41\text{ mL}}{1\text{ Gallon}} = 1670\text{ mL to be collected per aliquot}$		

# INTERNAL OUTFALL 503 4-HR FLOW PROPORTIONAL COMPOSITE SAMPLE EVENT FIELD NOTES

Date/Time pulse/aliquot calculation was completed (MM-DD-YY XX:XX AM/PM)			
Did discharge stop during discharge?		Select	
Total Duration of Stopped Flow:			
<b>Oil &amp; Grease Equipment Blank (Required 1/Week; DI Water Used)</b>			
Date Previous Collected (MM-DD-YY)	Week Next Required (MM-DD-YY)		Required Today?
	Week of:		Select
<b>Metals, Chloride, and TSS Equipment Blank (Required 1/2 Weeks; DI Water Used)</b>			
Date Previous Collected (MM-DD-YY)	Week Next Required (MM-DD-YY)		Required Today?
	Week of:		Select
<b>Oil &amp; Grease Field Blank (Required 1/Week; DI Water Used)</b>			
Date Previous Collected (MM-DD-YY)	Week Next Required (MM-DD-YY)		Required Today?
	Week of:		Select
<b>Metals, Chloride, and TSS Field Blank (Required 1/2 Weeks; DI Water Used)</b>			
Date Previous Collected (MM-DD-YY)	Week Next Required (MM-DD-YY)		Required Today?
	Week of:		Select
<b>In-Field Grab Sample:</b>	pH buffer solutions appear to be free of contamination or growth?		Select
	pH buffer solutions within the listed shelf-life?		Select
	pH Meter Calibration Time (XX:XX AM/PM)		
	Confirmation pH (SU) (10 buffer solution)		
	Confirmation pH temperature (°C) (10 buffer solution)		
	Confirmation pH (SU) (7 buffer solution)		
	Confirmation pH temperature (°C) (7 buffer solution)		
	Grab Sample Collection Time (XX:XX AM/PM)		
	Analysis Time: (XX:XX AM/PM)		<input type="checkbox"/> Required 48-hrs between 3/Week Grab Samples is Met (see Pre-Sample Event Requirements Section)
	pH (SU):		
Temperature (°C):			
<b>Performance Checks</b>			
Note: Below sampler checks are suggested. Notify Glover Construction Site Superintendent, Reuben Williams (252-578-7112), Possum Point Project Manager, (803-983-3344), and GAI Senior Project Engineer, Tim Lonas (814-244-4719) should system(s) fail. Do manual flow paced sampling if samplers are found to be inoperable.			
Performance Check #1	Date & Time of Check (MM/DD/YY XX:XX AM/PM)		
	Machine Operating as Programmed?	Select	



# INTERNAL OUTFALL 503 4-HR FLOW PROPORTIONAL COMPOSITE SAMPLE EVENT FIELD NOTES

Performance Check #2	Sample not frozen?	Select
	Date & Time of Check (MM/DD/YY XX:XX AM/PM)	
	Machine Operating as Programmed?	Select
	Sample not frozen?	Select

Sample Collection		
Sample Coolers Filled with Ice Before Lab Bottles Filled?	Select	
Temperature Blank Added to each Sample Cooler?	Select	
3/Week 4-hr Composite Sample ID (503-3/W-4HR-MM-DD-YY):	1/Month 4-hr Composite Sample ID (503-1/M-4HR-MM-DD-YY):	4-hr Composite Sample Date & Time Collected*
*Note: Time of collection of 4-hr composite sample corresponds with the time that the sample event ended.		
Field Blank Sample ID (503-1G-MM-DD-YY)	Field Blank Time of Collection (XX:XX AM/PM)	
Equipment Blank Sample ID (503-2G-MM-DD-YY)	Equipment Blank Time of Collection (XX:XX AM/PM)	
*Note: Time of collection of 4-hr composite sample corresponds with the time that the sample event ended.		
Equipment Decon:	Leftover collected sample water and decontamination waste shall be emptied to designated, labeled carboy (check all that apply): Equipment Decontamination Performed IAW the Sampling and Analysis Plan	<input type="checkbox"/> Extra Sample Water
		<input type="checkbox"/> Decontamination Waste
		<input type="checkbox"/> Decontamination Waste w/ Nitric Acid
		<input type="checkbox"/> Yes
		<input type="checkbox"/> No
High Flow Rate Peristaltic Pump Tubing (to be moved 6" along the pump head once every 7 days)	Previous date tubing moved 6" along the pump head (MM-DD-YY)	
	Next date tubing to be moved 6" along the pump head (MM-DD-YY)	
	Pump tubing moved 6" along the pump head?	Select
Chain-of-Custody Completed and Signed by Sampler?	Select	

**INTERNAL OUTFALL 503 4-HR FLOW PROPORTIONAL COMPOSITE SAMPLE EVENT FIELD  
NOTES**

Additional Comments:

X\_\_\_\_\_

Signature of Sampler #1

X\_\_\_\_\_

Signature of Sampler #2

Reminder: Upon completion of the sampling event, please complete the following tasks:

1. Relinquish custody of the samples by signing the Chain-of-Custody over to the courier. The courier must sign the COC to receive the samples. Keep a copy of the Chain-of-Custody in a binder in the laboratory trailer.
2. Scan and upload the Chain-of-Custody to the GAI Server in a folder corresponding to the sampling event date (Z:\Energy\2015\C150132.00 - DOM - Possum Point PS CCB\Working Docs\Task 65- Process and 503 Sampling\VPDES Reporting\COCs)
3. Scan and upload the Field Notes to the GAI Server in a folder corresponding to the sampling event date (Z:\Energy\2015\C150132.00 - DOM - Possum Point PS CCB\Working Docs\Task 65- Process and 503 Sampling\VPDES Reporting\Field Notes).



## Internal Outfall 503 24-HR Proportional Composite Sample Event Field Notes, Rev2

Date Range:

Virginia Electric and Power Company  
Possum Point Power Station  
Coal Combustion Residual Surface Impoundment Closures  
Dumfries, Virginia

GAI Project Number: C150132.00, Task 065

August 2016



**Dominion**<sup>SM</sup>

Prepared by: GAI Consultants, Inc.  
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Prepared for: Virginia Electric and Power Company  
5000 Dominion Boulevard  
Glen Allen, Virginia 23060-3308

00014238

# INTERNAL OUTFALL 503 24-HR FLOW PROPORTIONAL COMPOSITE SAMPLE EVENT FIELD NOTES

Sample Event Date & Time (MM-DD-YY XX:XX AM/PM to XX:XX AM/PM):		
Full Name of GAI Sampler:		
Full Name(s) of Other GAI Personnel Present with Sampler (if applicable):		
Dominion/Other Personnel Present with Sampler:		
Weather Conditions:		
Summary of Significant/Noteworthy Events From Sample Event Period:		

Pre-Sample Event Requirements		
DI Water Carboy Filled?	Select	
Leftover Sample Water Disposed of at the Head of the Treatment System?	Select	
Decontamination Waste Disposed per Dominion Direction?	Select	
Monitoring Requirements:	<input type="checkbox"/> [NON-UV TREATED] Chronic Toxicity, <i>C. dubia</i> ; Chronic Toxicity, <i>P. promelas</i>	
	<input type="checkbox"/> [NON-UV TREATED] Acute Toxicity, <i>C. dubia</i> ; Acute Toxicity, <i>P. promelas</i>	
	<input type="checkbox"/> [UV TREATED] Chronic Toxicity, <i>C. dubia</i> ; Chronic Toxicity, <i>P. promelas</i>	
	<input type="checkbox"/> [UV TREATED] Acute Toxicity, <i>C. dubia</i> ; Acute Toxicity, <i>P. promelas</i>	
Date/Time of Previous Sample (MM-DD-YY XX:XX AM/PM)		

Expected Pump Discharge Rate for Sampling Duration (GPM):		<input type="checkbox"/> Confirmed with contractor/treatment system operator
---	--	--

# of pulses between aliquot collections: **(Fill in expected flow and % discharge)** (1 pulse = 1,000 Gallons)

$$\text{Expected Pump Discharge Rate (GPM)} \times \frac{60\text{min}}{1\text{hr}} \times \frac{24\text{hrs}}{\text{Sampling Period}} \times \frac{1\text{ pulse}}{1,000\text{ Gallons}} \times \frac{1\text{ Sampling Period}}{72\text{ aliquots}}$$

$$= \frac{\text{pulses}}{\text{aliquot}}$$
  

$$\text{Expected Pump Discharge Rate (GPM)} \times 0.02 = \frac{\text{pulses}}{\text{aliquot}}$$

Note: Round up calculated pulses/aliquot to the nearest whole number.

Volume per aliquot (mL):

$$\frac{5.3\text{ Gallons for full ISCO Sample}}{72\text{ aliquots}} \times \frac{3785.41\text{ mL}}{1\text{ Gallon}} = 270\text{ mL to be collected per aliquot}$$

Date/Time pulse/aliquot calculation was completed (MM-DD-YY XX:XX AM/PM)		
Did discharge stop during discharge?	Select	
Total Duration of Stopped Flow:		

# INTERNAL OUTFALL 503 24-HR FLOW PROPORTIONAL COMPOSITE SAMPLE EVENT FIELD NOTES

<b>Acute Toxicity Equipment Blank (Required 1/2 Months; Laboratory-provided Control Water Used)</b>		
Date Previous Collected (MM-DD-YY)	Month Next Required	Required Today?
		Select
Note: If the date of the next required acute toxicity equipment blank is next month's sampling event, contact Scott Duda (412-399-5253) to order control water from the laboratory.		
<b>Chronic Toxicity Equipment Blank (Required 1/6 Months; Laboratory-provided Control Water Used)</b>		
Date Previous Collected (MM-DD-YY)	Month Next Required	Required Today?
		Select
Note: If the date of the next required chronic toxicity equipment blank is next month's sampling event, contact Scott Duda (412-399-5253) to order control water from the laboratory.		
<b>Acute Toxicity Field Blank (Required 1/2 Months; Laboratory-provided Control Water Used)</b>		
Date Previous Collected (MM-DD-YY)	Month Next Required	Required Today?
		Select
Note: If the date of the next required acute toxicity field blank is next month's sampling event, contact Scott Duda (412-399-5253) to order control water from the laboratory.		
<b>Chronic Toxicity Field Blank (Required 1/6 Months; Laboratory-provided Control Water Used)</b>		
Date Previous Collected (MM-DD-YY)	Month Next Required	Required Today?
		Select
Note: If the date of the next required chronic toxicity field blank is next month's sampling event, contact Scott Duda (412-399-5253) to order control water and sample bottles from the laboratory.		

<b>Performance Checks</b>		
Note: Below sampler checks are suggested. Notify Glover Construction Site Superintendent, Reuben Williams (252-578-7112), Possum Point Project Manager, (803-983-3344), and GAI Engineer-in-Training, Tim Lonas (814-244-4719) should system(s) fail. Do manual flow paced sampling if samplers are found to be inoperable.		
Performance Check #1	Date & Time of Check (MM/DD/YY XX:XX AM/PM)	
	Machine Operating as Programmed?	Select
	Sample not frozen?	Select
Performance Check #2	Date & Time of Check (MM/DD/YY XX:XX AM/PM)	
	Machine Operating as Programmed?	Select
	Sample not frozen?	Select
Performance Check #3	Date & Time of Check (MM/DD/YY XX:XX AM/PM)	
	Machine Operating as Programmed?	Select
	Sample not frozen?	Select
Performance Check #4	Date & Time of Check (MM/DD/YY XX:XX AM/PM)	
	Machine Operating as Programmed?	Select
	Sample not frozen?	Select

<b>Sample Collection</b>	
Sample Coolers Filled with Ice Before Lab Bottles Filled?	Select
Temperature Blank Added to each Sample Cooler?	Select

# INTERNAL OUTFALL 503 24-HR FLOW PROPORTIONAL COMPOSITE SAMPLE EVENT FIELD NOTES

24-hr Composite Sample ID (503-24HR-MM-DD-YY):		24-hr Composite Sample Time Collected (XX:XX AM/PM)	
Note: Write the sample ID above on the COC in any available space on the COC (preferably below the laboratory sample ID. Time of collection of 24-hr composite sample corresponds with the time that the sample event ended.			
Field Blank Sample ID (503-1G-MM-DD-YY)		Field Blank Time of Collection (XX:XX AM/PM)	
Equipment Blank Sample ID (503-2G-MM-DD-YY)		Equipment Blank Time of Collection (XX:XX AM/PM)	
Note: Write the sample ID above on the COC in any available space on the COC (preferably below the laboratory sample ID. Time of collection of 24-hr composite sample corresponds with the time that the sample event ended.			
Equipment Decon:	Leftover collected sample water and decontamination waste shall be emptied to designated, labeled carboy (check all that apply):	<input type="checkbox"/> Extra Sample Water	
		<input type="checkbox"/> Decontamination Waste	
		<input type="checkbox"/> Decontamination Waste w/ Nitric Acid	
	Equipment Decontamination Performed IAW the Sampling and Analysis Plan		Select
High Flow Rate Peristaltic Pump Tubing (to be moved 6" along the pump head once every 7 days)	Previous date tubing moved 6" along the pump head (MM-DD-YY)		
	Next date tubing to be moved 6" along the pump head (MM-DD-YY)		
	Pump tubing moved 6" along the pump head?		
pH at Start Recorded on Toxicity Chain-of-Custody?		Select	
Chain-of-Custody Completed and Signed by Sampler?		Select	

## INTERNAL OUTFALL 503 24-HR FLOW PROPORTIONAL COMPOSITE SAMPLE EVENT FIELD NOTES

Additional Comments:

X\_ \_\_\_\_\_

Signature of Sampler #1

X\_ \_\_\_\_\_

Signature of Sampler #2

Reminder: Upon completion of the sampling event, please complete the following tasks:

1. Relinquish custody of the samples by signing the Chain-of-Custody over to the courier. The courier must sign the COC to receive the samples. Keep a copy of the Chain-of-Custody in a binder in the laboratory trailer.
2. Scan and upload the Chain-of-Custody to the GAI Server in a folder corresponding to the sampling event date (Z:\Energy\2015\C150132.00 - DOM - Possum Point PS CCB\Working Docs\Task 65- Process and 503 Sampling\VPDES Reporting\COCs)
3. Scan and upload the Field Notes to the GAI Server in a folder corresponding to the sampling event date (Z:\Energy\2015\C150132.00 - DOM - Possum Point PS CCB\Working Docs\Task 65- Process and 503 Sampling\VPDES Reporting\Field Notes).



## **APPENDIX C**

### **ISCO 6172FR Flow Paced Sampler Catalog Cut**

# Isco 6712FR Fiberglass Refrigerated Sampler

The 6712FR is a sequential or composite refrigerated sampler designed for indoor or outdoor applications where rugged, corrosion-resistant construction is required. The extensive range of programming modes lets you select the most suitable routine for your application. Programming is fast and simple, with on-line help just a key stroke away.

The environmentally-sealed 6712 controller delivers maximum accuracy and easily handles all of your sampling applications, including:

- ◆ wastewater effluent
- ◆ stormwater monitoring
- ◆ CSO monitoring
- ◆ permit compliance
- ◆ pretreatment compliance

In the Standard Programming Mode, the controller walks you through the sampling sequence step-by-step, allowing you to choose all parameters specific to your application. Selecting the Extended Programming Mode lets you enter more complex programs.

## *Factory installed options*

An optional built-in telephone modem lets you change programs and download data remotely, from a touch-tone phone. It also has dial-out alarm features.



For automatic documentation of sample storage temperature, specify the 6712FR with optional temperature sensor. With this thermally ballasted sensor, the 6712 controller can log compartment temperatures at programmable intervals with 0.1°C precision.

## *Versatile, Tough, and Reliable*

Isco FR samplers feature a corrosion-proof refrigerator cabinet molded from polyester resin fiberglass and supported by a stainless steel frame. A UV-resistant gel coat provides a smooth, non-porous finish for added protection and easy cleaning.

The 6712FR uses thick, foamed-in-place insulation to keep samples preserved at the EPA-recommended 39°F (4°C). An automatically controlled, built-in heater ensures that samples won't freeze, even when ambient temperatures drop to -20°F (-29°C). Coolant is environmentally safe R134a. Durable powder-coated epoxy, phenolic paint, and polyester tubing, protect refrigeration components against corrosion.

*The 6712FR provides long service life in corrosive environments, and can be used outdoors without an enclosure.*



## Specifications

Isco 6712FR	
Size (HxWxD):	49.3 x 26 x 26 inches (125 x 66 x 66 cm)
Weight:	Dry, 160 lbs (73 kg)
Bottle configurations:	24 1-liter PP or 350-ml glass 24 ProPak 1-liter disposable sample bags 12 2.5-liter wedge PE 8 2-liter PE or 1.8-liter glass. 2 2-gallon (7.5-liter) PE or 2.5-gallon (9.4-liter) glass 1 2.5-gallon (9.4 liter) PE or glass 1 4-gallon (15-liter) PE 1 5.5-gallon (21-liter) PE or 5 gallon (19 liter) glass
Refrigerator Body	Fiberglass reinforced plastic with UV-resistant gel coat
Power Requirements:	120 VAC, 60 Hz; or 240 VAC, 50 Hz (specify)
Pump	
Intake suction tubing:	
Length	3 to 99 feet (1 to 30 m)
Material	Vinyl or Teflon
Inside dimension	3/8 inch (1 cm)
Pump tubing life:	Typically 1,000,000 pump counts
Maximum lift:	28 feet (8.5 m)
Typical Repeatability	±5 ml or ±5% of the average volume in a set
Typical line velocity at Head height: of	
3 ft. (0.9 m)	3.0 ft./s (0.91 m/s)
10 ft. (3.1 m)	2.9 ft./s (0.87 m/s)
15 ft. (4.6 m)	2.7 ft./s (0.83 m/s)
Liquid presence detector:	Non-wetted, non-conductive sensor detects when liquid sample reaches the pump to automatically compensate for changes in head heights.

Controller	
Weight:	13 lbs. (5.9 kg)
Size (HxWxD)	10.3 x 12.5 x 10 inches (26 x 31.7 x 25.4 cm)
Operational temperature:	32° to 120°F (0° to 49°C)
Enclosure rating:	NEMA 4X, 6 (IP67)
Program memory:	Non-volatile ROM
Flow meter signal input:	5 to 15 volt DC pulse or 25 millisecond isolated contact closure.
Number of composite samples:	Programmable from 1 to 999 samples.
Clock Accuracy:	1 minute per month, typical, for real time clock
Software	
Sample frequency:	1 minute to 99 hours 59 minutes, in 1 minute increments. Non-uniform times in minutes or clock times 1 to 9,999 flow pulses
Sampling modes:	Uniform time, non-uniform time, flow, random interval event. (Flow mode is controlled by external flow meter pulses.)
Programmable sample volumes:	10 to 9,990 ml in 1 ml increments
Sample retries:	If no sample is detected, up to 3 attempts; user selectable
Rinse cycles:	Automatic rinsing of suction line up to 3 rinses for each sample collection
Program storage:	5 sampling programs
Sampling Stop/Resume:	Up to 24 real time/date sample stop/resume commands
Controller diagnostics:	Tests for RAM, ROM, pump, display, and distributor

## Ordering Information

**Note:** Bottle configuration, suction line, and strainer must be ordered separately. Many options and accessories are available for 6712 Samplers; see separate literature for 700 Series Modules and other components to expand your monitoring capabilities.

Description	Part No.
6712FR Refrigerated Sampler, 120VAC 60Hz Includes controller, distributor arm, instruction manual, pocket guide.	68-6710-072
6712FR Refrigerated Sampler, 230VAC 50Hz includes controller, distribution arm instruction manual, pocket guide.	68-6710-073
6712FR with temperature logging, 120VAC 60Hz As above, with internal temperature sensor	68-6710-144
6712FR with temperature logging, 230VAC 50Hz As above, with internal temperature sensor	68-6710-145



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Internet: [www.teledyneisco.com](http://www.teledyneisco.com)



The 6712 Controller is also an SDI-12 data logger, and has many optional capabilities. Please contact Isco or your Isco distributor for more information.

## **APPENDIX D**

### **ISCO 6172FR Flow Paced Sampler Installation Instructions**

# 6712FR Refrigerated Sampler

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## *Section 2 Installation/Preparation*

### 2.1 Preparing the Sampler

The 6712FR is shipped to you with the controller mounted on the refrigerator and a distributor shaft extension installed. Use Figure 2-1 for reference when removing the controller. You must remove the controller when:

- The internal desiccant needs recharging, the internal battery needs to be replaced or when the controller needs repair.
- You install a different bottle kit.

Each bottle kit has its own extension so that the distributor arm is positioned at the right distance above the bottles. You must remove the controller to replace the extension.

#### 2.1.1 Installing the Distributor Shaft Extension

1. Install the extension before mounting the controller on the refrigerator.
2. Select the extension of the correct length for the bottle kit, and screw it on the distributor shaft. Secure it with the set screw. See Figure 2-1.

**BE SURE THE SET SCREW IS TIGHTENED INTO THE DISTRIBUTOR SHAFT'S KEY. YOU MAY HAVE TO LOOSEN THE EXTENSION SLIGHTLY AND ADJUST ITS POSITION.**

#### 2.1.2 Mounting the Controller

1. Install the four mounting rods into the bosses on the bottom of the case.
2. Fit the mounting rods through the four holes drilled in the top of the refrigerator.
3. Slip a washer on each rod and secure the controller by tightening the wing nuts.
4. Install the distributor arm and discharge tube.
5. Thread the stop arm into the hole in the side of the extension. Be sure the stop arm is directly above the distributor arm.
6. Connect the power cable to the controller.

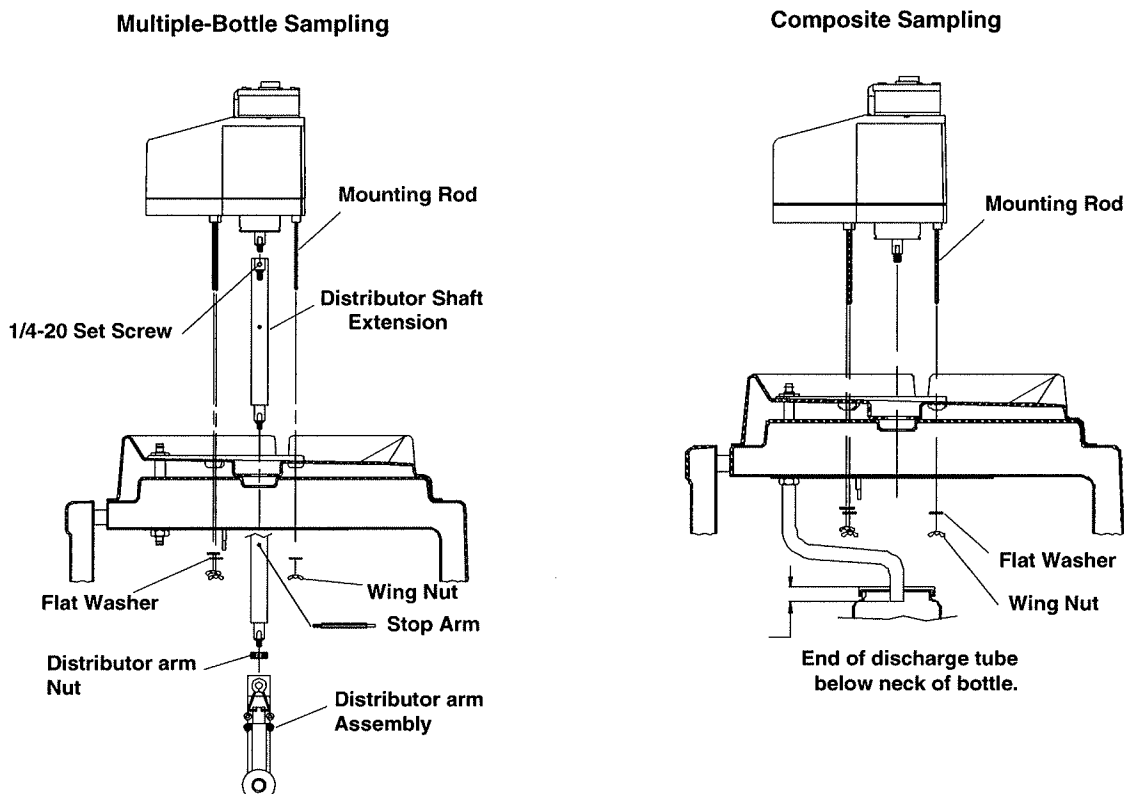
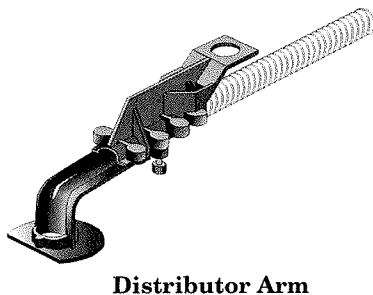


Figure 2-1 Mounting the Controller

### 2.1.3 Installing the Distributor Arm and Discharge Tube



The distributor arm is adjustable so that you can position the discharge tube over the bottles of each kit. Each bottle kit also uses a discharge tube of a specific length. Table 2-1 lists the correct discharge tube lengths for each bottle kit. If you are using bulk tubing to cut your own tubes, cut the ends of the tube square, not at an angle, and cut the length accurately.

The two-piece distributor arm has four positions, marked on the underside with the letters A, B, C, and D. Adjust the arm to the correct position for the bottle kit being used. Table 2-1 shows the correct position for each kit. Thread the discharge tube through the spring and arm so that the tube protrudes from the arm  $\frac{1}{16}$  to  $\frac{1}{8}$  inch. If too much tube protrudes from the arm it can catch on bottles and jam the distributor arm.

Attach the arm to the distributor shaft extension. Secure the arm to the extension with the black plastic nut. Slide the free end of the discharge tube onto the bulkhead fitting. After installing the distributor arm and discharge tube, run the distributor to each bottle position to ensure proper installation.

**Table 2-1 Distributor Arm Positions and Discharge Tube Lengths for Bottle Kits**

**24-Bottle Kits**

1000-milliliter polypropylene bottles  
350-milliliter glass bottles  
Distributor Arm Position: D  
Discharge Tube: 60-9003-279  
Discharge Tube Length: 20 inches (50.8 cm)  
Distributor Shaft: 60-9003-273  
Distributor Shaft Extension: 8<sup>11</sup>/<sub>16</sub> inches (22.0 cm)

**12-Bottle Kits**

2.5 liter polyethylene bottles  
Distributor Arm Position: D  
Discharge Tube: 60-9003-279  
Discharge Tube Length: 20 inches (50.8 cm)  
Distributor Shaft: 60-9003-273  
Distributor Shaft Extension: 8<sup>11</sup>/<sub>16</sub> inches (22.0 cm)

**8-Bottle Kits**

1.8 liter glass bottles  
2.0 liter polyethylene bottles  
Distributor Arm Position: B  
Discharge Tube: 60-9003-279  
Discharge Tube Length: 20 inches (50.8 cm)  
Distributor Shaft: 60-9003-274  
Distributor Shaft Extension: 10<sup>1</sup>/<sub>2</sub> inches (26.7 cm)

**2-Bottle Kits**

9.4 liter (2<sup>1</sup>/<sub>2</sub> gallon) glass bottles  
7.5 liter (2 gallon) polyethylene bottles  
Distributor Arm Position: A  
Discharge Tube: 60-9003-283  
Discharge Tube Length: 16 inches (40.6 cm)  
Distributor Shaft: 60-9003-275  
Distributor Shaft Extension: 6 inches (15.2 cm)

Composite Bottles	Discharge Tube	Discharge Tube Length
9.4 liter (2 <sup>1</sup> / <sub>2</sub> gallon) glass bottle	60-9003-262	17 <sup>1</sup> / <sub>4</sub> in (43.8 cm)
9.4 liter (2 <sup>1</sup> / <sub>2</sub> gallon) polyethylene bottle	60-9003-262	17 <sup>1</sup> / <sub>4</sub> in (43.8 cm)
15.0 liter (4 gallon) polyethylene bottle	60-9003-264	16 <sup>1</sup> / <sub>2</sub> in (41.9 cm)
18.5 liter (5 gallon) glass bottle	60-9003-266	15 <sup>3</sup> / <sub>4</sub> in (40 cm)
20.0 liter (5 <sup>1</sup> / <sub>2</sub> gallon) polyethylene bottle	60-9003-266	15 <sup>3</sup> / <sub>4</sub> in (40 cm)



## 2.2 Installing Bottle Kits

Teledyne Isco ships the refrigerator from the factory with the sample bottles in place. When using the sampler for the first time, you will only need to remove the bottle lids. When installing cleaned bottles or a new kit, keep these guidelines in mind:

- Do not mix glass and plastic bottles together.
- Install all bottles to insure that they remain in place.
- Align the racks correctly. If the racks are misaligned, the sampler may miss the bottle mouth, or the sampler will deposit samples in the “wrong” bottle.

Each time you change from one size bottle to another, you must adjust the length of the distributor arm, install a discharge tube of the correct length, and possibly install a different distributor shaft extension.

Each time you install a bottle kit, check the program settings for the number of bottles and bottle volumes. Also rotate the distributor arm to each bottle position to ensure the arm is correctly positioned over each bottle. Use the controller to move the arm.

### 2.2.1 Installing Racks

Install the bottle rack with bottles by sliding it into the cooling compartment until the rack drops over the two semicircular ramps which hold it in place (Figure 2-2).

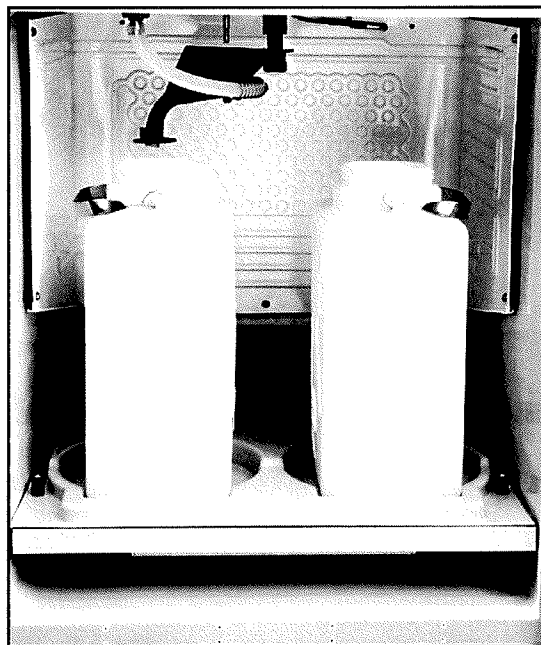
The five posts and two ramps which position the rack under the distributor arm are adjusted at the factory. When you change bottle kits, you may need to readjust the stops and ramps and install a different distributor arm extension. Figures 2-3 and 2-4 show you how to install the bottle kits.

Check the kit's alignment by rotating the distributor arm. **Do not rotate the distributor manually. Moving the arm manually damages the distributor drive.** If you see any misalignment, adjust the posts and ramps until the discharge tube at the end of the arm stops over each bottle.



**24-Bottle Kit**

1000-milliliter polypropylene bottles.



**2-Bottle Kit**

(Requires a locating base.)

*Figure 2-2 Installing the Bottle Racks*

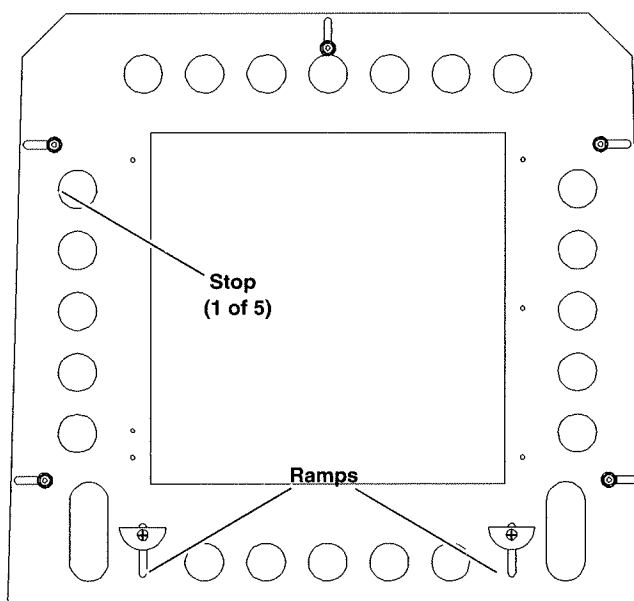
Install the distributor shaft extension. Use the  $8\frac{11}{16}$ -inch extension for the 12- and 24-bottle kits. Use the  $10\frac{1}{2}$ -inch extension for the 8-bottle kit. The instructions on page 2-1 show you how to remove the controller and replace the extensions for each bottle kit.

Next, adjust the distributor arm to position D for the 12-bottle and 24-bottle kits, or to position B for the 8-bottle kit. Install the arm and stop. See Installing the Distributor Arm and Discharge Tube on page 2-2.

Slide the rack, with bottles installed onto the mounting plate. Adjust the stops and ramps on the plate so that the rack is centered and held firmly on the plate.

Finally, position the arm over each bottle. If the arm does not stop over each bottle, readjust the rack.

**NEVER MANUALLY ROTATE  
THE DISTRIBUTOR ARM.**



*Figure 2-3 Installing the 24-bottle, 12-bottle, and 8-bottle Kits*

Install the distributor-shaft extension. Use the 5 $\frac{1}{4}$ -inch extension for the 2-bottle kit. The instructions on page 2-1 show you how to remove the controller and replace the extensions for each bottle kit.

Next, replace the controller, and adjust the distributor arm to position A. Install the arm and stop. See Installing the Distributor Arm and Discharge Tube on page 2-2.

Install over the mounting plate at the bottom of the refrigerator, the locating base which holds the 2 $\frac{1}{2}$ -gallon glass or 2 gallon polyethylene bottles.

Begin by loosening the ramps. Move them toward the front of the compartment so that they will fit under the ridge of the locating base. (You can also remove them completely.)

Remove the two front stops, and align the holes on the sides of the locating base with the holes for the stops in the mounting plate. Secure the base by replacing the stops.

Install the bottles, and position the arm over each bottle.

**NEVER MANUALLY ROTATE  
THE DISTRIBUTOR ARM.**

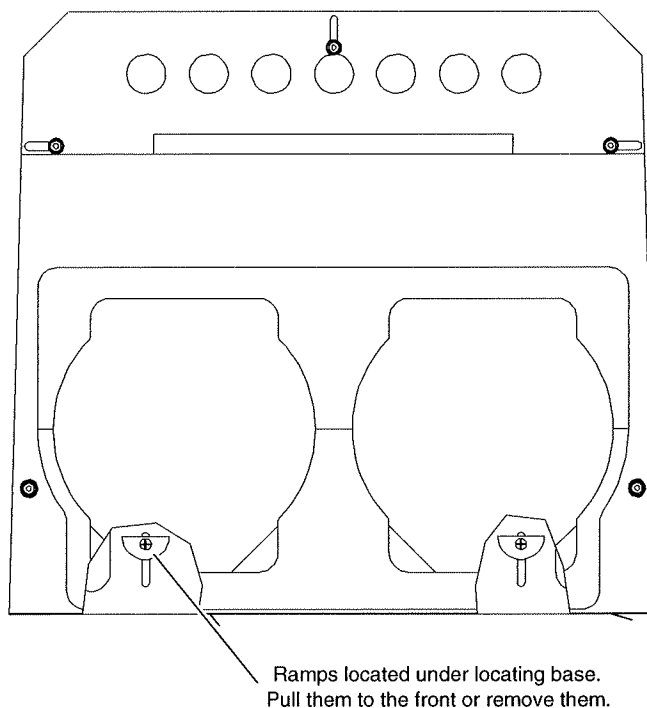


Figure 2-4 Installing the 2-bottle Kit

### 2.2.2 Removing Racks

Before removing the rack, place the lids on the bottles so the samples do not spill. Remove the bottle rack by lifting the front edge of the rack slightly to disengage it from the two ramps. Then, pull it straight out of the refrigerator. Be careful not to catch the distributor arm against the bottles.

### 2.2.3 Installing Composite Bottles

Remove the distributor arm and discharge tube. Remove the distributor arm stop. If using the two bottle locating base, remove it. Slide the composite bottle discharge tube on the bulkhead fitting.

Composite bottle kits have two lids, one with a hole drilled in the center. Screw the lid with the hole in it on the bottle, and place the bottle in the center of the mounting plate.

Thread the discharge tube through the hole in the lid. Always use the lid to retain the discharge tube. It prevents the sampler from spraying liquid inside the sample compartment instead of the bottle.

## 2.3 Suction Line

The suction line is the tubing from the sampling point to the pump intake. The 6712FR uses a  $\frac{3}{8}$ -inch ID suction line of lengths 3 to 99 feet. Teledyne Isco offers vinyl or PTFE suction lines. The PTFE tubing has a polyethylene jacket to protect it from kinks and abrasions.

The vinyl line contains a very low parts-per-million level of phenols. If phenol content affects your sample analysis, use the PTFE suction line.

When installing the sampler, be sure the vertical distance between the liquid level and the pump is as small as possible.

### 2.3.1 Guidelines for Measuring and Cutting the Suction Line

- Cut the line to the desired length but use the shortest length feasible for the installation.
- Cut the line in 1 foot increments. For instance, 4 feet, not  $3\frac{1}{2}$ . If using metric units of measure, cut the line in increments of 0.1 meter. Do not include the length of the strainer in the measurement.

### 2.3.2 Attaching Suction Line to Pump Tube

Attach the vinyl suction line to the pump tube with the  $\frac{3}{8}$ -inch tubing coupler. First, screw the threaded end into the suction line until the flat surface is flush against the suction line (Figure 2-5). Then, push the other end of the coupler into the end of the pump tube until the other flat surface is flush against the tubing.

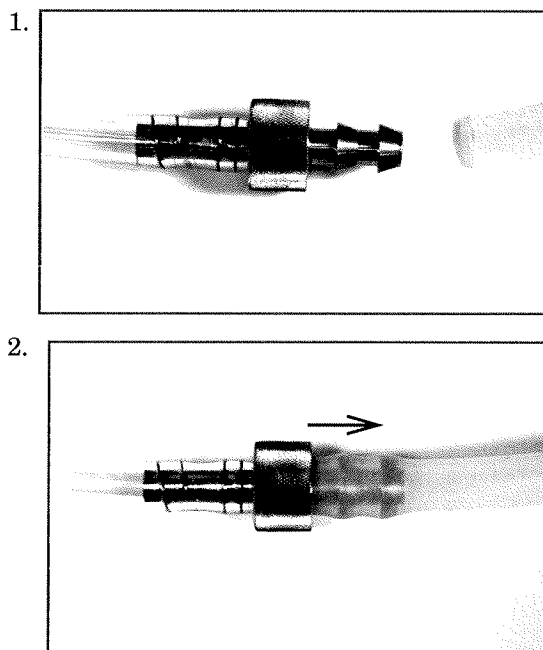


Figure 2-5 Attaching the suction line to the pump tubing

Once the coupler is attached to the pump tube, removal is difficult, and may require cutting the tube.

## 2.4 Strainers

Teledyne Isco offers three styles of strainer that help prevent solids from clogging the suction line:

- $\frac{3}{8}$ -inch standard weighted polypropylene strainer for routine and priority pollutant sampling
- $\frac{3}{8}$ -inch stainless steel low flow strainer
- Weighted CPVC-coated strainer for acidic liquid sources

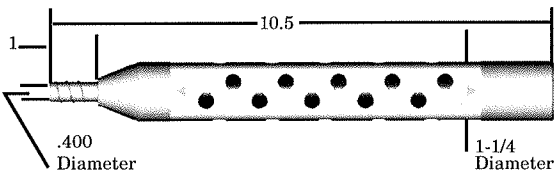
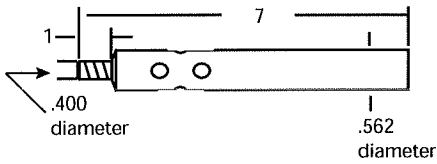
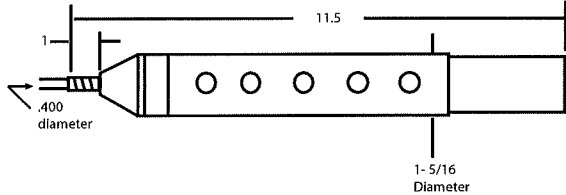
To select the right strainer for your application, see Table 2-2.

To install the optional low flow strainer in PTFE suction line, heat the end of the suction line to make it more pliable, then carefully screw the strainer's threaded connector into the suction line.

### 2.4.1 Alternative to Strainers

When sampling from high velocity streams with heavy suspended solids, some field investigations suggest that more representative samples are obtained without the strainer. Consider attaching a short piece of thin walled aluminum tubing to the end of the suction line; anchor the tubing so that the inlet opens upstream. The aluminum tubing's thin wall will not disturb the flow stream, and most sample analyses disregard aluminum ions. Under most conditions, the pre-sample purge removes any debris over the tubing entrance.

**Table 2-2 Selecting the Right Strainer**

Strainer	Dimensions	Application	Maximum Depth
<b><math>\frac{3}{8}</math> Stainless Steel Ends, Polypropylene Center</b>		Routine applications.	Vinyl Line: 22 feet (6.7m). PTFE Line: 15 feet (4.5m).
<b><math>\frac{3}{8}</math> Stainless Steel Low Flow</b>		Low flow applications	Vinyl Line: 22 feet (6.7m). PTFE Line: 15 feet (4.5m).
<b><math>\frac{3}{8}</math> CPVC</b>		Highly acidic liquids.	Vinyl Line: 4 feet (1.2m).

#### ☒ **Note**

- The suction lines will float when filled with air during the purge cycles and when depths exceed the listed ratings. Secure the suction lines when sampling at depths exceeding the maximum ratings.
- All strainer dimensions are in inches.
- PTFE suction line is compatible only with the  $\frac{3}{8}$  stainless steel strainer.

## 2.5 How Does the Sampler Work?

When the sampler takes a sample, it draws liquid through the strainer and suction line to the pump tube. The liquid flows through the pump tube and past the liquid detector, which senses the liquid. From the detector, the liquid follows the pump tube through the pump to the bulkhead fitting and then through the discharge tube to the sample bottle.

A typical sampling cycle consists of:

1. The sampler moves the distributor arm over the bottle that is to receive the sample.
2. The pump reverses for the pre-sample purge.
3. The pump direction changes, filling the suction line.
4. When the detector senses liquid, the sampler begins measuring the sample.
5. After depositing the sample, the pump again reverses for the post-sample purge.

Sampling cycles vary somewhat according to program settings for distribution. The sampler can move the distributor arm clockwise and counterclockwise, making a number of distribution methods possible. (In this manual, the words "sample event" refer to a full sampling cycle for any distribution.)

- a. Controller.
- b. Peristaltic pump.
- c. Liquid Detector.
- d. Strainer
- e. Suction line
- f. Stainless Steel Coupling
- g. A pump tube routed from the liquid detector's intake port through the pump, out the detector's discharge port, and over the side of the controller to a bulkhead fitting.
- h. Bulkhead fitting.
- i. Discharge tube running from the bulkhead through the spring and distributor arm.
- j. Distributor arm and spring.

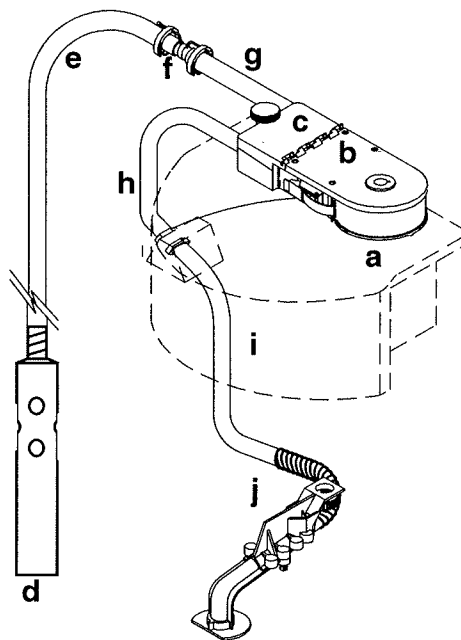


Figure 2-6 Identifying the Sampler Components

Other variations include extended-program settings for suction-line rinses and sampling retries. A sampler running a program with line rinses completes the pre-sample purge and

then rinses the line. The suction line is purged after each rinse. When programmed for sampling retries, the sampler will attempt to pump a sample again if it fails on previous attempts.

### 2.5.1 Measuring Sample Volume

“Sample volume” refers to the amount of liquid delivered into a bottle. The volume is determined by the programmed value. The volume is dependent on the volume per revolution of the pump, which is dependent on the suction head. The 6712FR delivers the sample by counting the pump revolutions and automatically compensating for the suction head.

## 2.6 Installing the Sampler

The following segment briefly describes initial sampler installation.

### CAUTION

Tests indicate that the pump produces sound levels in excess of 85db at one meter. Prolonged exposure to this sound could result in hearing loss and requires the use of protective ear plugs.

### CAUTION

When using the 6712FR sampler with a 750 or 710 module, transmitters such as cell phones or walkie talkies must not be operated within 3 meters of the sampler. If water level readings are fluctuating due to TV/radio station transmitter towers in the area, the sampler must be relocated.

### WARNING

The 6712FR samplers have not been approved for use in hazardous locations as defined by the National Electrical Code.

### WARNING

If you must enter a manhole or other dangerous location to install the sampler, observe standard safety precautions. Refer to Appendix C for a discussion of safety considerations.

### 2.6.1 Tips for Routing Suction Line

Route the line so that it runs continuously downhill from the sampler to the liquid source. This helps drain the line during pre-sample and post-sample purges. When the sampler is used in below freezing temperatures, there is a risk of the suction line being frozen. A suitably warm sampling source can usually prevent this, provided there are no loops in the suction line. Some situations may require more protective measures, such as insulation of the suction line, or heat tape. Thoroughly draining the suction line minimizes the possibility of frozen liquid clogging the line.



### 2.6.2 Intake Placement

For representative samples, place the intake in the main current of the flow stream, not in an eddy or at the edge of flow. Placing an intake at the bottom may produce samples with excess heavy solids and no floating materials, while placement at the top may produce the opposite conditions.

### 2.6.3 Positioning a Sampler

Place the refrigerator on a relatively flat, horizontal surface. Placing the refrigerator on a steep incline may cause the sample to miss the bottle mouth.

When installing the sampler, be sure the vertical distance between the level of the liquid and the pump is as small as possible.

### CAUTION

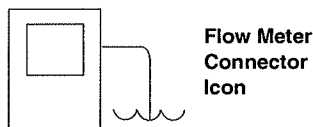
The refrigerator's lower compartment is not watertight. Do not install in a location where the refrigerator's lower compartment could become submerged.

## 2.7 Connecting External Instruments

The 6712FR sampler can be used in conjunction with several types of external instruments.

### 2.7.1 Flow Meter

To connect the sampler to an Isco open-channel flow meter, 4100 series flow logger, 2100 series flow module, or 1640 Liquid Level Actuator, attach the sampler-to-flow meter cable to the Flow Meter Connector. To connect the sampler to a closed-pipe flow meter, attach an Isco 4-20 mA Input Interface device to the sampler's Flow Meter connector. Plug the line cord into an AC power outlet. Be sure it is connected to 120 volts AC (optional 230 volts AC). When using the sampler with an external instrument, remember these guidelines:



- Both the sampler and the flow instrument must be on and running a program.
- If using a flow meter, logger, or module for flow pacing, the sampler and the flow instrument must both run programs with flow pacing settings.
- If using a flow meter or flow logger for trigger pacing, the sampler must run a program with flow pacing settings, and the flow instrument must run a program with trigger pacing settings.
- When the sampler runs an event-paced program, it disregards pacing pulses from a flow meter or flow logger. However, the sampler continues to monitor for enable signals.

### 2.7.2 Rain Gauge Connector

Attach the rain gauge, SDI-12 Sonde, or Refrigerator Temperature Sensor cable connector to the nine-pin Rain Gauge port. When connecting a rain gauge and an SDI-12 Sonde, or rain gauge and a Refrigerator Temperature Sensor, use the appropriate 'Y' cable. For part numbers and ordering information, see the Accessories appendix at the end of this manual.

To operate with an SDI-12 sonde, the sampler must be placed in Extended Programming mode, and SDI-12 Sonde Setup must be selected from the Hardware Setup menu (refer to Section 5.18).

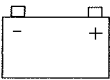

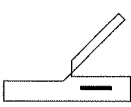
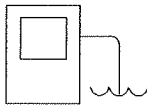
For complete SDI-12 sonde setup instructions, refer to Section 6.



### **WARNING**

**Most Isco flow meters are not certified for use in hazardous locations as defined by the National Electrical Code. Contact your Teledyne Isco representative for your equipment's status. Never operate equipment in hazardous locations that has not been certified as safe for such use. Refer to Appendix C in the back of this manual for more safety information.**

**Table 2-3 Connecting Isco Instruments to the Sampler**

Connector Icon	Connect These Instruments:
<b>Power Source</b> 	12 volt power source
<b>Rain Gauge</b> 	674 Rain Gauge Programmable I/O Pins (pins C, H, and I) SDI-12 Sonde Refrigerator Temperature Sensor
<b>Interrogator</b> 	581 RTD (Rapid Transfer Device) IBM PC or compatible computer running FLOWLINK External Modem External Data Logger/Controller
<b>Flow Meter</b> 	1640 Liquid Level Actuator 2100 Series Flow Modules 3000 Series Flow Transmitters 4100 Series Flow Loggers 4200 Series Flow Meters Master/Slave Sampler Pulse Duration Input Interface 4-20 mA Input Interface Closed-Pipe Flow Meter (with 4-20 mA Input Interface)

## 2.8 Locking the Sampler

The refrigerator is equipped with a lockable latch for the top cover and a lockable catch for the door handle. To lock the refrigerator, use two padlocks, one for the top cover and one for the door.

## 2.9 Servicing the Sampler

Servicing the sampler includes:

- Collecting the filled sample bottles and replacing them with clean bottles;
- Collecting the data recorded by the sampler during the program.

Samplers are usually serviced after they complete a sampling program. When working up a service schedule, you will need to estimate the program completion time. You should also be familiar with the program's settings for the start time or if the sampler is programmed for continuous sampling.

Continuous sampling is controlled by the distribution setting entered at the "RUN CONTINUOUSLY?" screen. A "YES" response directs the sampler to reset the distribution sequence and continue the countdown to the next sample event. Appropriate service intervals will prevent overfilled bottles.

## **APPENDIX E**

### **ISCO 6172FR Flow Paced Sampler Programming Instructions and Information**

# 6712FR Refrigerated Sampler

## Section 3 Programming Introduction

Before programming the 6712FR, you should become familiar with its keys and how to use the screens.

The 6712FR Sampler has two sets of programming modes. The first mode, **Standard Programming**, lets you set up typical sampling programs easily and efficiently. The second mode, **Extended Programming**, lets you create sophisticated programs for complex sampling applications.


All of the sampling features available in standard programming mode are available in extended programming mode. However, extended programming provides many additional features.

Standard and extended programming features are explained in separate sections. This section focuses on some basic features that are common to both programming modes, such as using the menus and setting the clock.

### CAUTION

This sampler has a high performance pump. As with all such pumps, it relies upon liquid to cool working components. If the sampler is programmed to pump in the absence of liquid in excess of 5 minutes, excessive heat buildup may damage the paddles, rollers, and housing. Ensure that the liquid inlet is completely immersed.

### 3.1 Initial Operation

Turn the sampler on by pressing the Standby key. It is labeled with this icon: . The start-up screen appears first.

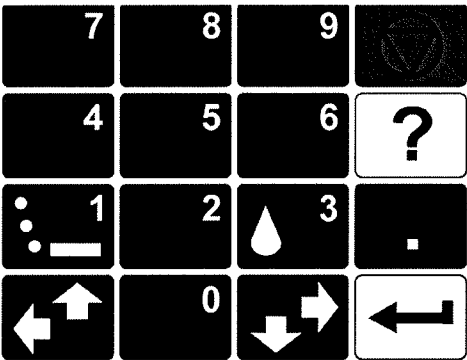










6712 SAMPLER  
STANDARD PROGRAMMING  
For HELP at any  
screen press ? key.

It remains on the display for about eight seconds or until you press a key. It tells you the type of programming screens the sampler is currently using — standard or extended — and gives you a tip about the on-line help. The main menu screen, shown below, appears next.

RUN  
PROGRAM  
VIEW REPORT  
OTHER FUNCTIONS

(If a module is attached, a different screen may appear first. See the module manual for more information.)

**Table 3-1 About the Keypad**

		
Key	Name	Function
	Standby	Turns sampler on or off.
	Stop	Stops the pump or distributor. Pauses a running sampling program. In programming screens, returns to a previous screen.
	Enter	Accepts a menu choice or number entry and goes to next screen.
	Help	In programming screens, displays a brief help message.
	Down-Right Arrow	Selects the menu option right or below the current choice.
	Up-Left Arrow	Selects the menu option left or above the current choice.
	Numbers	Types a number.
	Decimal Point	Types a decimal point.
	Pump Reverse	Press when at the main menu to run the pump in reverse.
	Pump Forward	Press when at the main menu to run the pump forward.

The sampler is programmed at the factory so that the standard programming screens appear when you first turn the sampler on. You can switch between programming modes by typing in a numerical command at the main menu:

- At the main menu type **6712.2** to show the extended programming screens.
- At the main menu type **6712.1** to show the standard programming screens.

The sampler will continue to use the program mode you selected, even if the sampler is turned off and on again, until you manually switch to the other programming mode.

With the display backlight activated, the screen will glow for several seconds following your last keystroke.

If you press a key and the screen text does not change, it is probably because the keystroke turned the backlight on, instead of performing its function. Press the same key again.

### 3.1.1 Selecting a Language

You have the option of having screens display in English or another language. The default is English. At the main menu, type **6712.8**:

ENGLISH SPANISH
--------------------

Use the arrow keys to move between the choices (languages other than those shown above could appear on your unit). When the language choice you want is blinking, press ↵(Enter). The ↵ (Enter) key always accepts the blinking option.

## 3.2 Using Menus and Entering Numbers

### The Main Menu

RUN PROGRAM VIEW REPORT OTHER FUNCTIONS
--

A menu is a list of options. The main menu has four options:

- RUN
- PROGRAM
- VIEW REPORT
- OTHER FUNCTIONS

The options identify the operations that can be performed from the menu. For example, to run the sampling program, select RUN; to modify the program, select PROGRAM.

### 3.2.1 Selecting Menu Options

In menu screens, one menu option always blinks.

- Press ↵ when the blinking option is the one you want; it will accept your choice and go to the next screen.
- Select a different option by pressing an arrow key until the option you want blinks. Then press ↵.

### 3.2.2 Entering Numbers

Number-entry screens prompt you to enter a value. An example is shown to the left.



SUCTION LINE LENGTH  
IS      ft  
(3-99)

- Type the length of the suction line. Acceptable values are shown between the parentheses. Press  $\downarrow$  to accept the number.

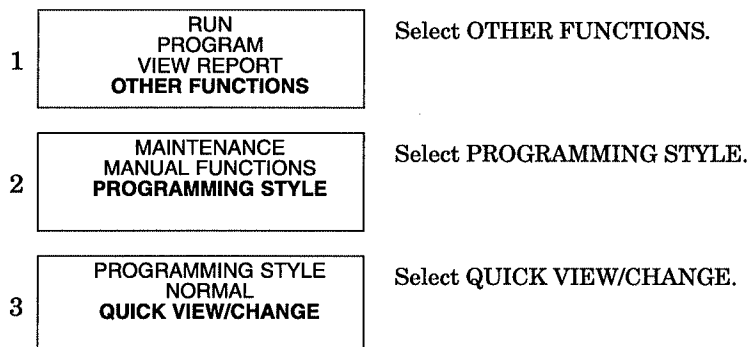
To enter a number:

Press the number keys to type the number. Then, press  $\downarrow$ . As soon as you press  $\downarrow$ , the sampler saves your number and moves to the next screen. In some screens, you can use the . (Decimal Point) key in a number.

Some screens display the range of acceptable numbers between parentheses. If an entry is too low or high, the controller beeps and erases the entry. Type a new number and continue.

### 3.3 Quick View Screens

Quick View screens are a special type of menu screen. They show the current program settings and let you move quickly through the program. You must change the programming style to QUICK VIEW/CHANGE to see the quick view screens, as shown below:



#### 3.3.1 Paging Through Quick View Screens

The arrows in the corners of each quick view screen are menu options that let you move from one quick view screen to another.

Select the up arrow ( $\uparrow$ ) to go to the previous screen.

Select the down arrow ( $\downarrow$ ) to go to the next screen.

Press Stop to return to the main menu.

Because the forward arrow is always blinking when the screen appears, you can simply press  $\downarrow$  to go to the next quick view screen, making it easy to page through the screens.

#### 3.3.2 Changing Settings in a Quick View Screen

Although the quick view screens offer you a quick way to see the program settings, they also provide you with a way to change settings. Using quick view screens to change settings is sometimes a faster way to change a program because you can go quickly to the setting or settings that needs updating.

To change the program settings in a quick view screen:

Press an arrow until the setting blinks. Press  $\downarrow$ . The 6712 then displays the screen used to change the setting.

The following Quick View screens show you how to change the sample volume. Begin by paging through the quick view screens until you see the screen containing the sample volume setting:

RUN  
PROGRAM  
VIEW REPORT  
OTHER FUNCTIONS

- To see the Quick View screens, select PROGRAM.

↑  
SITE DESCRIPTION:  
"SITE 29 "  
↓

- Use the keypad's arrow key to select ↓ for the next quick view screen. When ↓ is blinking, press ↵.
- Use the keypad's arrow key to select ↑ for the previous quick view screen. When ↑ is blinking, press ↵.
- Use the keypad's arrow key to select the program setting. When the setting is blinking, press ↵ to display the screen used to change the setting.
- Press Stop for the main menu.
- All quick view screens work the same way.

↑  
200 ml SAMPLES  
↓

- Press the arrow key until 200 ml SAMPLES blinks. Then press ↵.

SAMPLE VOLUME:  
250 ml (10-1000)

- Type the new sample volume and press ↵.

↑  
250 ml SAMPLES  
↓

When you change a setting, the sampler stores the new settings and returns to the updated quick view screen. You can repeat this process until all settings shown in the quick view screens have been changed. When you are done, select the screen's forward arrow to move to the next quick view screen, or press Stop to return to the main menu.

### 3.4 Clock and Calendar

You may have to set the internal clock or calendar. The samplers are shipped with their clocks set to U.S. Central Standard time. If your sampler operates in a different time zone, you will have to reset the clock. The example below shows you how to find the time and date screen.

### Entering Times and Dates

ENTER TIME AND DATE:  
HH:MM DD-MON-YY  
\_:\_ \_-\_-\_-

- Move from one field to another by pressing the arrow keys.
- Change a setting in a field by typing a number. Press  $\downarrow$  to accept the new setting.

When setting the clock and calendar, use a 24-hour clock for times and the day-month-year format for dates. The illustration at the left shows blanks for each position that accepts an entry. The positions are called fields. When this screen appears on your sampler, the fields will contain the sampler's current settings for the time and date.

- To move from one field to another without changing the setting, press the arrow keys. Use this technique when you want to change only one or two settings.
- Change the setting by typing a new number. Press  $\downarrow$  to accept the new setting.

For example, to enter 2:00 p.m. (2:00 p.m is 14:00 on a 24-hour clock), type 14. Press  $\downarrow$ . Next, type 0 (zero) for the minutes, and press  $\downarrow$ . To enter a date, such as January 22, 2001, type: 22  $\downarrow$  01  $\downarrow$  01  $\downarrow$ .

#### 3.4.1 Setting the Clock and Calendar

- |   |  |  |
|---|--|--|
| 1 | RUN<br>PROGRAM<br>VIEW REPORT<br><b>OTHER FUNCTIONS</b>                | Select OTHER FUNCTIONS.                |
| 2 | <b>MAINTENANCE</b><br>MANUAL FUNCTIONS<br>PROGRAMMING STYLE            | Select MAINTENANCE.                    |
| 3 | <b>SET CLOCK</b><br>PUMP TUBE ALARM<br>INTERNAL BATTERY<br>DIAGNOSTICS | Select SET CLOCK.                      |
| 4 | ENTER TIME AND DATE:<br>HH:MM DD-MON-YY<br>14:00 22-JAN-01             | Enter the time and date.               |
| 5 | SET CLOCK<br>PUMP TUBE ALARM<br>INTERNAL BATTERY<br>DIAGNOSTICS        | Press Stop to return to the main menu. |

#### 3.4.2 Menu Screens: Clock Start Times

There are four start time settings you can use in a sampling program. This section discusses only one of these settings, the clock start time. A clock start time lets you set up a sampling program that starts at the same time on one or more days of the week. For example, you may want to begin sampling at 6:00 a.m. on Monday through Friday (refer to the screen below).

To select a day or days from the menu:

1. Press an arrow key until the cursor is on the correct day. Then, press  $\downarrow$ .
2. Repeat these steps until each day you want is blinking.
3. Press an arrow until DONE blinks. Press  $\downarrow$ .

To remove days from the list:

1. Press an arrow key until the cursor is on the day you want to remove. Press  $\downarrow$  to deselect it.
2. When finished, select DONE and press  $\downarrow$

NO DELAY TO START  
DELAYED START  
**CLOCK TIME**  
WAIT FOR PHONE CALL

### Using the Clock Start Time Menu

- Select CLOCK TIME.

FIRST SAMPLE AT:  
06:00

- Type the time of day and press  $\downarrow$ .

SELECT DAYS:  
SU MO TU WE TH FR SA  
  
DONE

- Press an arrow key until the cursor is on the correct day. Then, press  $\downarrow$ . To remove a day, move the cursor to it and press  $\downarrow$  to deselect it.
- Repeat these steps until each day you want is blinking.
- Press an arrow until DONE blinks. Press  $\downarrow$ .

## 3.5 Menu Screens: Site Descriptions and Program Names

The sampler has two text-entry menus, one for site description and another for an extended-program name. They work in the same way. A site description is commonly a number, address, or other short note that helps identify the monitoring site. Extended programming has a similar screen that lets you enter program names for stored programs.

The example on the next page shows how to change the site description from FACTORY01 to SITE 29. Line 1 contains text between two quotation marks. Lines 2 and 3 contain the menu options — numbers, letters, and punctuation marks — used to spell out the description. In line 3, the space between the ampersand (&) and the double quotes (") is a space character. Line 4 contains two additional options:

- BACK-UP, an option that moves the cursor on the text line to the left one character.
- DONE, an option that tells the sampler to save the text.

### Changing the Site Name

```
SITE: "FACTORY01"  
ABCDEFGHIJKLMNQRST  
UVWXYZ-& "0123456789  
BACK-UP  DONE
```

```
SITE: "SACTORY01"  
ABCDEFGHIJKLMNQRST  
UVWXYZ-& "0123456789  
BACK-UP  DONE
```

- Press the Down-Right arrow until the **S** on line 2 blinks. Then, press ↵.

```
SITE: "SICTORY051"  
ABCDEFGHIJKLMNQRST  
UVWXYZ-& "0123456789  
BACK-UP  DONE
```

- Press the Up-Left arrow until the **I** blinks. Press ↵.

- Continue pressing arrow keys to select **T**, **E**, and space. Press ↵ after selecting each character.

```
SITE: "SITE_29_ "  
ABCDEFGHIJKLMNQRST  
UVWXYZ-& "0123456789  
BACK-UP  DONE
```

- Press 29 on the keypad, then Up-Left until space blinks. Press ↵.

```
SITE: "SITE_29_ "  
ABCDEFGHIJKLMNQRST  
UVWXYZ-& "0123456789  
BACK-UP  DONE
```

- Press the Down-Right arrow until **DONE** blinks. Press ↵.

The cursor is the blinking rectangle that identifies the current field. When the screen first appears, the cursor blinks on the first character of the text in line 1. The matching character in line 2 or 3 also blinks.

When you press ↵, the cursor on line 1 moves to the right one position, and, at the same time, the sampler blinks on the matching character on lines 2 or 3.

To change any character in the text line:

1. Press the left or right arrow until the replacement character on lines 2 or 3 blinks.
2. Press ↵. The replacement character will appear on the first line, and the cursor will move to the next character.

*Repeat steps 1 and 2 until the text in the top line is complete.*

3. Finish the entry by selecting **DONE**. Then, press ↵.

Some additional tips for using the text-entry menus:

- Hold an arrow key down for faster movement.
- If your description uses all ten spaces in the text line, the sampler automatically moves to the next screen as soon as you add the tenth character.
- You can enter numbers by pressing the number keys.
- Erase characters by replacing them with a space character.
- Select the **BACK-UP** option to move the cursor to the left.
- To leave the menu before completing the entry, press **Stop**. The sampler will display this menu:

```
SAVE CHANGES?  
YES  NO
```

Select **YES** to save any changes made. Select **NO** to leave the original description (or program name) unchanged.

## 3.6 Messages

The sampler has four sets of messages that supplement the programming screens. **Information messages** tell you about programming status. **Help Notes** are brief comments associated with programming screens describing the setting or offering assistance. **Warning messages** tell you something is different from Isco's standard. **Operation messages** report the sampler's status as it runs a program.

**3.6.1 Information Messages** These are brief messages about the programming status, such as “ROM’ PASSED TEST” or the status message that displays when you first start up the sampler. Information messages are displayed for four seconds, unless they are terminated by pressing any key on the keypad.

**3.6.2 Help Notes**

To see a Help note:

1. Press the ? (Help) key.
2. When the note requires several screens, the word “more” appears in the lower-right corner. Press ↵ for the next note.
3. Move back and forth between screens by pressing the arrow keys.
4. Press Stop at any time to return to the programming screen.

Most help notes refer to a related section in this manual. Screens that require extensive explanation have notes that contain only a reference to the manual. Sections mentioned in the notes appear in the index and the table of contents.

SUCTION LINE LENGTH  
IS 7 ft  
(3-99)

- Press ? (Help).

Enter the length of  
suction line only,  
excluding strainer  
and pump tube.      <more>

- Press ↵ or Down-Right to see the next screen.
- Press Stop to return to the programming screen.

See “Installing  
Suction Line” in  
your manual.      <more>

- Press ↵ or Down-Right to see the next screen.
- Press Up-Left to see the previous screen.
- Press Stop to return to the programming screen.

Press the red STOP  
key to exit HELP.

- Press Up-Right to see the previous notes.
- Press Stop to return to the programming screen.

**Using Help Notes**

Although this example shows the Help Notes that are associated with the suction line length screen, you can use the same technique to see help notes for other screens.

### 3.6.3 Warning Messages

Warning messages appear when the sampler determines something is out of the ordinary. For example, the following warning appears when you type a number that is larger than the standard bottle volume:

BOTTLE VOLUME IS  
3500 ml (300-30000)

WARNING!  
STANDARD BOTTLE  
VOLUME EXCEEDED!

The 6712 does accept nonstandard volumes because you might use a nonstandard container occasionally. For a list of recommended volumes for Isco bottles press the ? (Help) key at the "Bottle Volume Is" screen, or refer to the Technical Specifications.

The 6712 uses the bottle and sample-volume settings to determine the maximum number of samples that can be deposited without overfilling the bottles. Entering a volume that exceeds the standard volume may cause the sampler to overfill the bottle.

### 3.6.4 Operation Messages

An operation message reports the sampler's status as it runs a program. An example is shown below.

PROGRAM WILL START  
AT 06:00 TU 20-FEB  
  
05:56:22 TU 20-FEB

## 3.7 Menu Trees

Selecting a menu option will take you to a number-entry screen or another menu screen. The screens are organized in a branching structure that resembles a tree. Refer to Figure 3-1 for a simple chart of the menu tree for standard programming. The standard programming structure is different — much simpler — than the extended programming structure. Charts that show you most of the sampler's screens appear in *Appendix A, Flowcharts*.

The entire structure changes a little when a module is attached because the sampler adds a set of screens for a module as soon as it detects the module's presence. The manuals for each module contain menu trees for its programming screens.



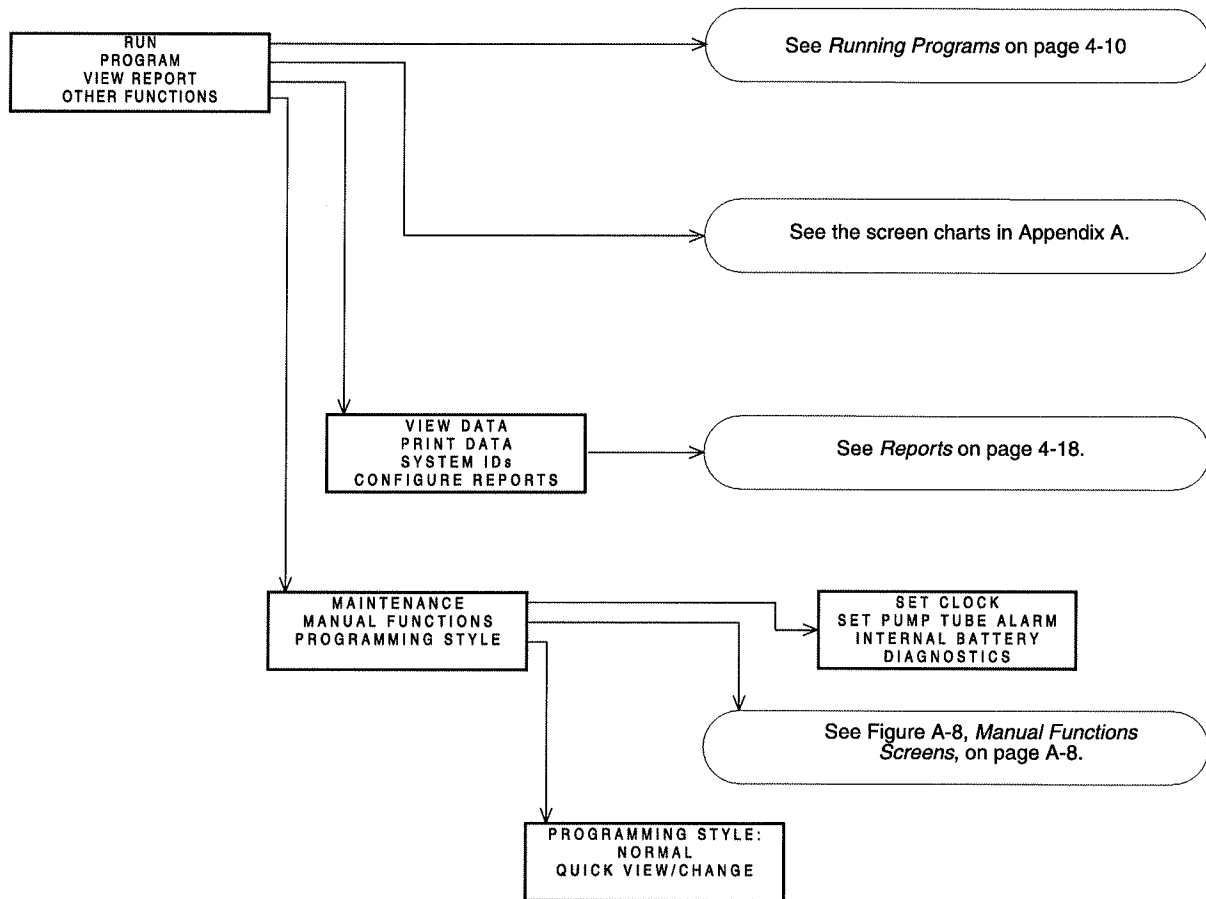


Figure 3-1 Menu Tree for Standard Programming



# 6712FR Refrigerated Sampler

## Section 4 Standard Programming

The 6712FR Sampler has two sets of programming screens. The first set, called standard programming screens, lets you set up typical sampling programs easily and efficiently. The second set, extended programming screens, lets you create sophisticated programs for complex sampling applications.

All of the sampling features available within the standard programming screens are available in extended programming. However, extended programming provides several additional features which are discussed in the next section. Menu flowcharts for both sets of programming screens are in Appendix A.

### 4.1 Switching Between Standard and Extended Modes

Factory default settings cause the sampler to begin in standard programming mode the first time you turn it on. The start-up screen tells you which programming mode the sampler is currently using. You can switch between programming modes by entering a numerical command at the main menu:

- At the main menu, type **6712.1** to enter standard programming mode.
- At the main menu, type **6712.2** to enter extended programming mode.

RUN  
**PROGRAM**  
VIEW REPORT  
OTHER FUNCTIONS

**Main Menu**

### 4.2 Language Selection, Units of Length

You have the option of displaying screens in English or Spanish (or possibly another language). The default is English. At the main menu, type **6712.8** to display:

ENGLISH  
SPANISH

Use the arrow key to move between the two choices. When the desired choice is blinking, press ↵.

If you select the English option, you will advance to a second screen that asks you to select your units of length:

SELECT UNITS FOR  
LENGTH:  
ft   m

Use the arrow key to move between the two choices, feet or meters. When the desired choice is blinking, press ↵. The default unit of length for the Spanish option is meters.

### 4.3 Programming Examples

The following table is an example of time-paced sampling. Further details about some of the menu items are provided in later sections.

**Table 4-1 Standard Program: Sample Every 15 Minutes, One Sample Per Bottle**

1	6712 SAMPLER STANDARD PROGRAMMING For HELP at any screen press ? key.	Turn the sampler on by pressing the On/Off key. Press ↵.  This screen disappears on its own after 8 seconds.
2	RUN PROGRAM VIEW REPORT OTHER FUNCTIONS	The option PROGRAM will be blinking. Press ↵.
3	SITE DESCRIPTION: "FACTORY051" CHANGE? YES NO	The option NO will be blinking. Press ↵. For the purposes of this example, it isn't necessary to change the description.
4	NUMBER OF BOTTLES: 1 2 4 8 12 24	Select the number of bottles in your bottle kit by pressing either arrow key until the correct number blinks. Press ↵. For this example, select 24.
5	BOTTLE VOLUME IS 1000 ml (300-30000)	Type the volume for the bottles in your kit. For this example, 1000 is correct, so simply press ↵.
6	SUCTION LINE LENGTH IS 10 ft (3-99)	Type the length of the suction line, then press ↵. If you change the length, the sampler will display a message, "PLEASE WAIT! . . . GENERATING PUMP TABLES."
7	TIME PACED FLOW PACED	Because this example requires samples every 15 minutes, select TIME PACED by pressing an arrow until the option TIME PACED blinks. Then, press ↵.
8	TIME BETWEEN SAMPLE EVENTS 0 HOURS, 15 MINUTES	Type 0 for hours and press ↵. Type 15 for minutes and press ↵. Tip: Move back and forth between hours and minutes by pressing an arrow key.
9	SEQUENTIAL BOTTLES/SAMPLE SAMPLES/BOTTLE	Because this program requires one sample in each bottle, select SEQUENTIAL by pressing an arrow until the option SEQUENTIAL blinks. Then, press ↵.
10	RUN CONTINUOUSLY? YES NO	For this example, select NO by pressing an arrow until the option blinks. Then, press ↵. Selecting YES allows the program to run indefinitely by repeating the sample distribution. Continuous sampling assumes that filled bottles are replaced with empty bottles at regular service intervals.

**Table 4-1 Standard Program: Sample Every 15 Minutes, One Sample Per Bottle (Con-**

11	SAMPLE VOLUME: 200 ml (10-1000)	Type the volume of the sample you want deposited in each bottle. Then, press ↵.
12	NO DELAY TO START <b>DELAYED START</b> CLOCK TIME WAIT FOR PHONE CALL	For this example, select <b>DELAYED START</b> by pressing an arrow until the option blinks. Then, press ↵.
13	FIRST SAMPLE AFTER A 5 MINUTE DELAY (1-999)	Type the delay period you want between the time you run the program and the time the sampler takes the first sample. Then, press ↵.
14	PROGRAMMING COMPLETE RUN THIS PROGRAM NOW? YES NO	Run the program immediately by selecting YES. Select NO if you want to run the program later by selecting RUN from the main menu. Press ↵ after making your choice. In this example, NO is selected.
15	<b>RUN</b> PROGRAM VIEW REPORT OTHER FUNCTIONS	Run the program by selecting RUN and pressing ↵.

The following table is an example of flow-paced sampling.

- Program type: Standard
- Site description: SITE 29
- Bottle kit: 24, 1000 milliliter bottles
- Suction line length: 7 feet
- Pacing: Flow pacing, every two pulses
- Distribution: 2 bottles per sample
- Sample Volume: 250 milliliters
- Start time: Clock Time, 6:00 a.m. on Monday, Wednesday, Friday
- Module: No module installed

**Table 4-2 Standard Program: Flow-Paced Sampling, Two Bottles Per Sample**

1	6712 SAMPLER STANDARD PROGRAMMING For HELP at any screen press ? key.	
2	<b>RUN</b> <b>PROGRAM</b> VIEW REPORT OTHER FUNCTIONS	Select PROGRAM.
3	SITE DESCRIPTION: "FACTORY051" CHANGE? YES NO	Select NO.

**Table 4-2 Standard Program: Flow-Paced Sampling, Two Bottles Per Sample (Contin-**

4	<div> NUMBER OF BOTTLES:  1 2 4 8 12 <b>24</b> </div>	Select 24.
5	<div> BOTTLE VOLUME IS  1000 ml (300-30000) </div>	Enter 1000.
6	<div> SUCTION LINE LENGTH  IS 10 ft  (3-99) </div>	Enter 7.
7	<div> TIME PACED  <b>FLOW PACED</b> </div>	Select FLOW PACED.
8	<div> FLOW BETWEEN  SAMPLE EVENTS:  2 PULSES (1-9999) </div>	Enter the number of pulses between sample events.
9	<div> SEQUENTIAL  <b>BOTTLES/SAMPLE</b>  SAMPLES/BOTTLE </div>	Select BOTTLES/SAMPLE.
10	<div> RUN CONTINUOUSLY?  YES <b>NO</b> </div>	For this example, select NO by pressing an arrow until the option blinks. Then, press ↵. Selecting YES allows the program to run indefinitely by repeating the sample distribution. Continuous sampling assumes that filled bottles are replaced with empty bottles at regular service intervals.
11	<div> 1 BOTTLES PER  SAMPLE EVENT (1-24) </div>	Enter 2.
12	<div> NO DELAY TO START  DELAYED START  <b>CLOCK TIME</b>  WAIT FOR PHONE CALL </div>	Select CLOCK TIME.
13	<div> START FLOW COUNT AT:  00:00 </div>	Enter 6, then enter 0. This is the time at which the sampler will start the pacing countdown.
14	<div> SELECT DAYS:  SU <b>MO</b> TU WE TH FR SA  DONE </div>	Select MO, WE, and FR. Use the arrow keys and ↵ to select the days. When the correct days are blinking, select DONE and press ↵.
15	<div> PROGRAMMING COMPLETE  RUN THIS PROGRAM  NOW?  YES <b>NO</b> </div>	Select NO.

## 4.4 Pacing

### Standard Time Pacing and Flow Pacing Screens for Samplers without Flow Modules

TIME PACED  
FLOW PACED

- When programming, you will be asked to select time or flow paced sampling. Depending upon your choice, you will see one of the following screens:

TIME BETWEEN  
SAMPLE EVENTS:  
\_\_ HOURS, \_\_ MINUTES

FLOW BETWEEN  
SAMPLE EVENTS:  
\_\_\_\_ PULSES (1-9999)

### Flow Pacing Screen for Samplers with Flow Modules

FLOW BETWEEN  
SAMPLE EVENTS:  
\_\_\_\_ Mgal  
(0.001 -99999)

Sample pacing is the rate at which the sampler takes samples. Depending on the type of pacing you select, the rate is controlled by the sampler's internal clock or by inputs received from connected instruments.

Standard programming provides time pacing and flow pacing (refer to Step 7 in the previous two programming examples). In time-paced sampling, the interval between samples is a constant time interval. When you program the sampler for time pacing, the sampler prompts you to enter the time between sample events in hours and minutes. Time paced programs always take a sample at the start time.

Flow paced sampling requires a flow meter, flow logger, or a module. A flow meter or flow logger paces a sampler by sending an electronic signal to the sampler after measuring a specified volume of liquid. Because each pulse represents a volume interval, flow pacing rates are proportional to the volume of water flowing through the channel.

When you program the sampler for flow pacing and are using a flow meter or flow logger, the sampler prompts you to enter the interval between sample events in pulses. The sampler initiates a sample event when the set number of pulses is received. Programs that are flow paced do not take a sample at the start time.

After setting the program start time, you will be prompted to enter a maximum run time of zero to 999 hours. If you would like the program to run indefinitely, enter 0 (zero) for maximum run time.

The flow pacing screens change when you attach a flow module (see example to the left). Because the sampler is more closely integrated with the modules, the standard flow pacing screen prompts you for the flow volume between sample events instead of pulses between events. The flow volume units displayed are what you had previously programmed.

### 4.4.1 Trigger Pacing

Isco 4200 Series Flow Meters and 4100 Series Flow Loggers send pulses for trigger pacing. The flow meter or flow logger sends pulses at two different time intervals when trigger pacing a sampler. Trigger pacing, for example, lets you sample less frequently when the trigger condition — a condition based on level, flow, or rainfall — remains below a set point. The intervals are determined by the flow instrument's program settings for trigger pacing.

When conditions change and readings pass the set point, triggering the new rate, you can sample more frequently. Or, when the trigger condition is a clock setting, the instrument changes the pacing interval according to the time of day. Using a clock trigger condition, for instance, the flow meter or flow logger can pace the sampler slowly at night and more frequently during the day. (For more information about trigger pacing, see your flow meter or FLOWLINK manual.)



The flow meter or flow logger sends the same pulse for both flow and trigger pacing, and the sampler cannot distinguish between them. Therefore, to program a sampler for trigger pacing, simply program it for flow pacing.

## 4.5 Distribution

Distribution describes how the sampler is to deposit samples. A sample is the volume of liquid deposited in a bottle. A sample event includes the full sampling cycle and may deposit a sample into more than one bottle.

In standard programming, you can program the sampler for these different distribution methods:

- Sequential
- Bottles Per Sample
- Samples Per Bottle
- Composite

### 4.5.1 Sequential

In sequential distribution, the sampler deposits one sample in each bottle. A sequential sample represents a “snapshot” of the flow stream at a point in time.

### 4.5.2 Bottles Per Sample

In bottles per sample distribution, the sampler deposits a sample in each of a set of bottles. A bottle set includes at least two bottles but may include all bottles. Use bottles per sample when the volume to be collected is larger than the amount one bottle can hold or when you need identical samples.

### 4.5.3 Samples Per Bottle

In samples per bottle distribution, the sampler deposits samples from several sample events in a single bottle before moving to the next bottle. Use samples per bottle distribution to collect a series of small composite samples.

### 4.5.4 Composite

For single bottle configurations, samples per bottle distribution is known as composite sampling. A composite sample represents an average of the flow stream’s characteristics during the sampling period.

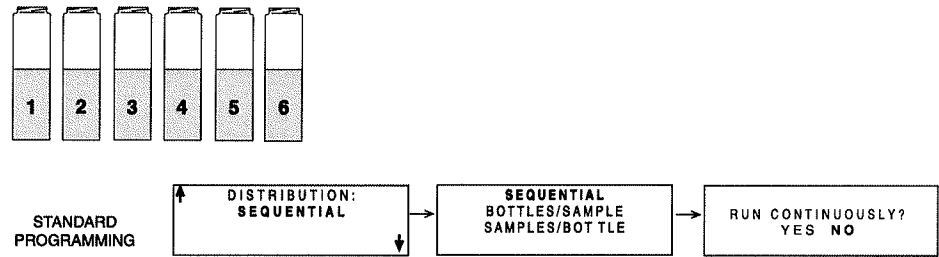
### 4.5.5 Continuous Sampling

Sample programs can be run indefinitely by selecting “YES” at the “RUN CONTINUOUSLY?” screen. Continuous sampling resets the distribution when the distribution sequence is complete. That is, when the last bottle/set is reached, the next bottle/set is the first bottle/set. All pacing modes except RANDOM are supported.

When running a program continuously, the bottles must be serviced at regular intervals to prevent overfilling the bottles. The sampler assumes that the next bottle/set is empty and ready to receive samples.

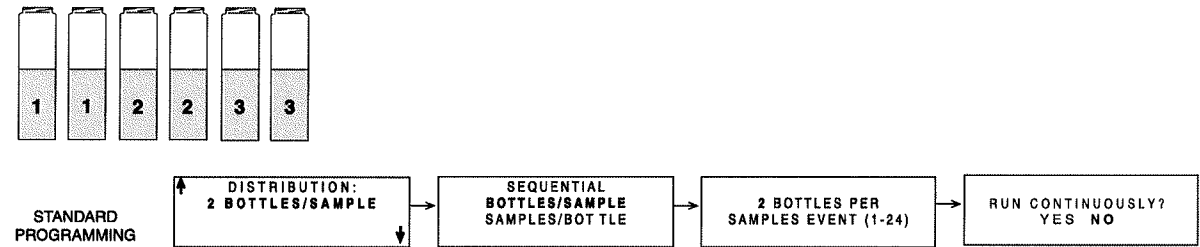
The figure on the next page steps through the programming screens for sequential, bottles per sample, and samples per bottle distribution.

**Sequential**



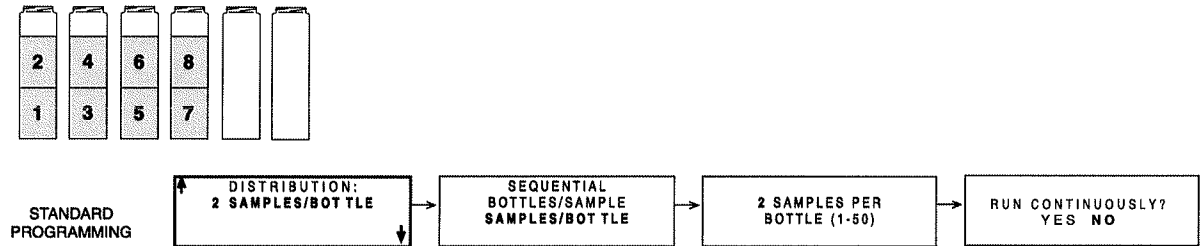
Each bottle receives one sample from one sample event.

**Bottles-per-Sample**



Multiple bottles receive a sample from one sample event.

**Samples-per-Bottle**



Each bottle receives a sample from multiple sample events.

Figure 4-1 Sample Distribution

## 4.6 Start Times

It is important to understand the difference between the time at which you run a program and the program's start time. Running a program simply means selecting RUN from the sampler's main menu. The start time is the time at which the sampler begins the program's first sample interval countdown. The start time is controlled by your selections from the start time screens.

Each program contains start-time settings that tell the sampler when to begin the program. When programming the sampler, you can select one of four start time options: NO DELAY TO START, DELAYED START, CLOCK TIME, or WAIT FOR PHONE CALL.

- Select NO DELAY TO START when you want the sampler to start as soon as you select RUN.
- Select DELAYED START when you want the sampler to delay from 1 to 999 minutes before starting the program.
- Select CLOCK TIME when you want the sampler to begin the program at a specific time on at least one day of the week.
- Select WAIT FOR PHONE CALL when you want the sampler to begin the program after receiving a remote command to start.

### 4.6.1 How Do Start Times Work?

As soon as you select RUN from the main menu, the sampler checks the program's start time settings. With a "DELAYED START" setting, the sampler starts a countdown to the start time. The period between the time you select RUN and the start time you've specified in the program is called the "delay to start time."

When you run a program with "CLOCK TIME" settings, the sampler also starts a countdown to start time until the day of week and clock times are met.

The sampler may not collect a sample at the start time. The sampler must be enabled, and the pacing selected must call for a sample at start. In any event, the sampler checks the pacing settings and begins the pacing-interval countdown.

### Delayed Start Screen

1 NO DELAY TO START  
DELAYED START  
CLOCK TIME  
WAIT FOR PHONE CALL

- Select DELAYED START.

2 FIRST SAMPLE  
AFTER A  
\_\_\_ MINUTE DELAY  
(1-999)

- Enter the number of minutes to delay the countdown to the first sample.

3 START FLOW COUNT  
AFTER A  
\_\_\_ MINUTE DELAY  
(1-999)

- The sampler uses this screen for flow paced programs.

### Clock Start Time Menu

1 NO DELAY TO START  
DELAYED START  
CLOCK TIME  
WAIT FOR PHONE CALL

- Select CLOCK TIME.

2 FIRST SAMPLE AT  
06:00

- Enter the time of day.

3 SELECT DAYS:  
SU MO TU WE TH FR SA  
DONE

- Press an arrow key until the cursor is on the correct day. Press  $\downarrow$ .
- Repeat until each day you want is blinking.
- Press an arrow until DONE blinks. Press  $\downarrow$ .

#### 4.6.2 Sampler Enable/Disable

Isco flow meters and flow loggers have a programmable sampler-enable feature that lets them enable (start) or disable (stop) a program according to certain monitored conditions. For example these conditions can be level, flow rate, pH, temperature, percent, rainfall, I/O; or a combination of two conditions.

The Model 1640 Liquid Level Actuator can also be used, as well as any other instrument that can ground the input to pin F. Grounding the input disables the sampler.

The sampler disregards disable signals during the delay to start time. However, when the sampler detects a disable signal at the start time, it suspends the program until it is enabled. The diagram in Figure 4-2 shows the sampler's responses.

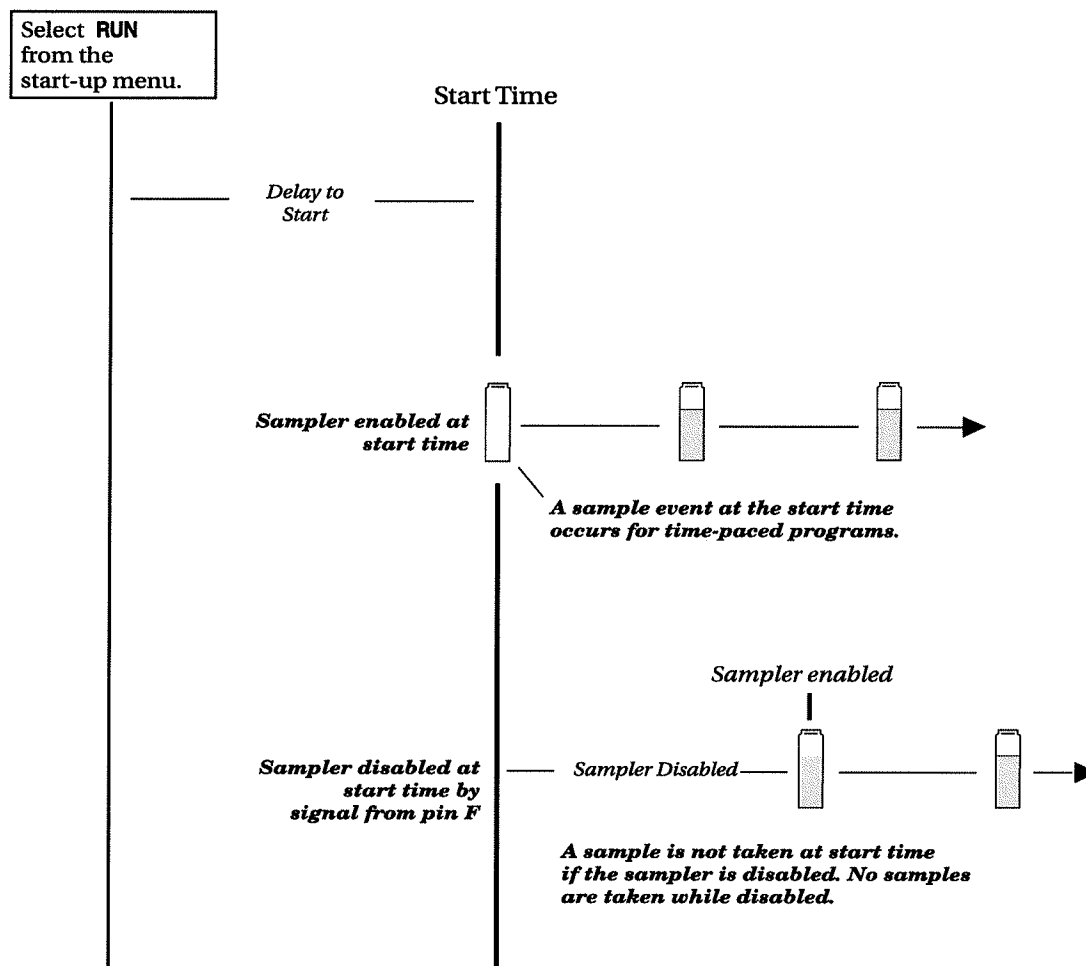


Figure 4-2 Start Time Diagram

## 4.7 Running Programs

To run a program, select RUN from the main menu. You may also select YES at the RUN THIS PROGRAM NOW? screen at the end of the programming screens.

### 4.7.1 Run Time Screens

While running a sampling program the sampler displays a variety of messages that report the program's status. For example, if the sampler has not yet reached the programmed start time, it displays the scheduled start time as well as the current time.

Once the program reaches the start time, you can determine the time of the next sample, the next bottle to receive a sample, sample distribution, and other information. Other messages appear while the sampler runs through a sampling cycle and takes a sample. When the sampler needs to report multiple messages, it alternates them, displaying each for one to three seconds.

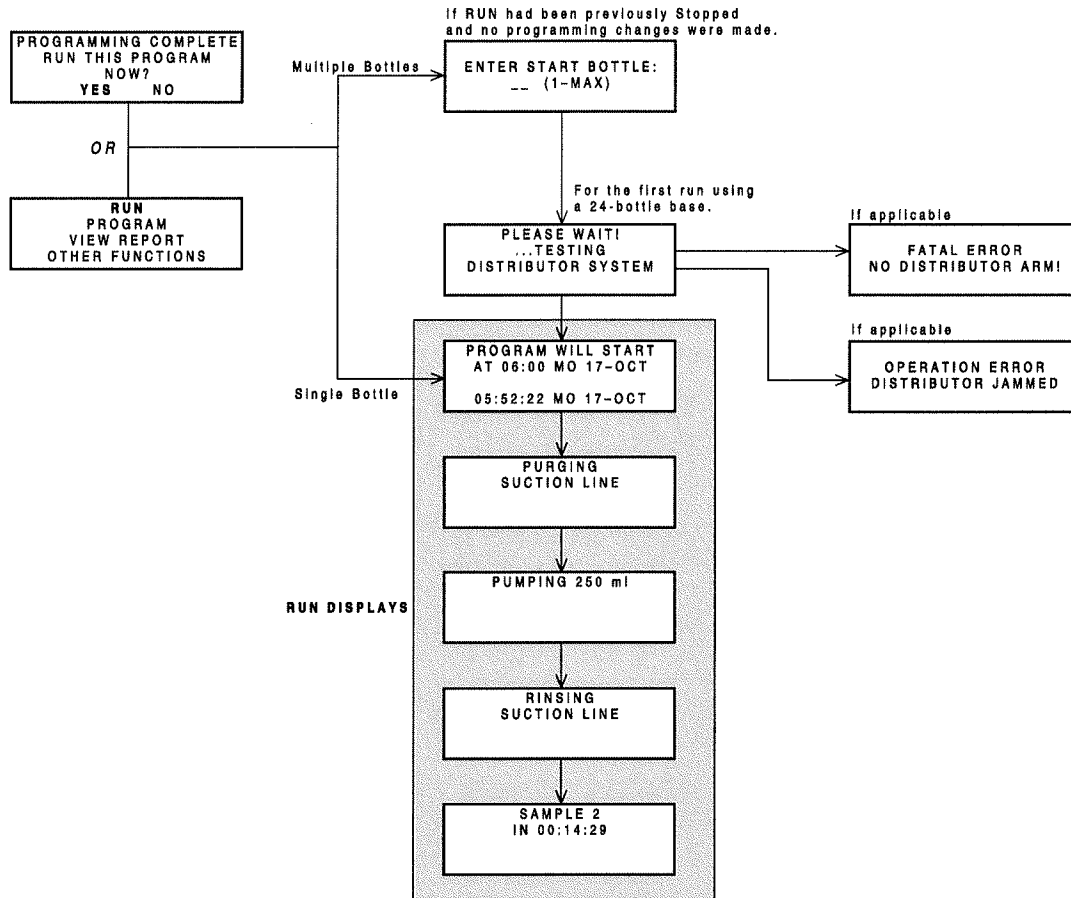


Figure 4-3 Running a Program

#### 4.7.2 Module Readings

Samplers with an attached module display the module's readings: pH and temperature for the pH module; level, percentage, or flow rate for the 4-20 mA module; level, flow rate, and flow volume readings for the flow modules; level, velocity, flow rate, and positive flow volume readings for the area velocity module. Some module screens will alternate with the sampler screens.

BOTTLE 2
IN 00:14:39
150 gpm    0.82 ft
00001438200 gal

The Module readings are updated:

- Every second when displaying the reading during programming.
- Every minute otherwise.

BOTTLE 2
IN 00:12:00
***** gpm    5.73 ft
00001457600 gal

An asterisk (\*) appears next to the reading if the module was unable to take a reading. If an asterisk appears, the reading displayed is the last available reading. Flow rates will be reported as zero flow if the error persists for more than five minutes (for a level or velocity reading that flow is calculated from).

If an entire reading is filled with asterisks, the value exceeds the number of characters that can be displayed. The sampler stores the actual reading in memory, so it may be collected later.

For those programs that have delayed or scheduled start times, the readings will be displayed while waiting for the start time. Keep in mind that any totalizer values will be reset at the start time. Module and sonde readings are also displayed after a program is complete, until a key is pressed.

It is not necessary to run a program to view module or sonde readings. Real time data can be viewed on the display by selecting "VIEW REPORT" from the main menu.

## 4.8 Interrupting a Running Program

You can interrupt a sampling program by pressing the Stop key while the sampler is waiting for the next sample event. Pressing Stop places the sampler into *Manual Paused* operation and records a manual pause in the sample event log.

In this state, the sampler allows you to access several functions. You can modify the program, reset alarms, take a grab sample, etc., without adversely affecting the running program. Modifying the program is limited to adjusting the pacing intervals, enable conditions and sample volume. The basic program structure, such as the type of pacing, can not be changed.

While in the manual paused state, the sampling program continues to operate as normal, with the exception of taking samples. If a sample was to be taken, it is skipped. The sampler records "sample skipped" in the sample event log and continues to operate as normal.

The manual paused state displays a scrolling menu with several options (see example below). Use the Arrow keys to scroll through the manual paused options and the  $\downarrow$  key to make a selection. Return to the running program by selecting resume program or pressing the Stop key. If you do not make a selection, the sampler automatically resumes the original sampling program five minutes after the last key was pressed.

← STOP PROGRAM
RESUME PROGRAM
VIEW DATA
GRAB SAMPLE →

Manual Paused Screen

### 4.8.1 Stop Program

This option terminates the running program and records program stopped in the sample event log. The program cannot be resumed.

### 4.8.2 Resume Program

Selecting this option will cause the sampler to exit the manual paused state and return to normal program operation. A manual resume event will be logged.

- 4.8.3 View Data** This option allows you to view the data recorded by the sampler. See *Reports* on page 4-18 for more information.
- 4.8.4 Grab Sample** When selected, you will be asked to enter the volume to be pumped. A sample will then be taken as if it is to be *placed into a container outside the sampler*. Do this by removing the pump tubing from the bulkhead fitting. See *Grab Samples* on page 4-14. A grab sample event will be logged.
- 4.8.5 Pump Tube Alarm** If the pump tube is changed, this option should be selected to reset the pump counts on the counter. This will remove the “WARNING: REPLACE PUMP TUBING” message that may appear while the program is running. A pump tube replaced message is logged. See *Replacing The Pump Tube* in Section 7, Maintenance.
- 4.8.6 Calibrate Volume** When selected, you will be asked to enter the volume to be pumped. A sample will then be taken as if it is to be *placed into a container outside the sampler base*. Do this by removing the pump tubing from the bulkhead fitting.  
After the sample has been pumped, you will then be asked to enter the amount actually delivered. Once you have entered the delivered volume and accepted the calibration, a volume delivered event will be logged.
- 4.8.7 Cal/Adj Parameters** When the sampler is configured for operation with a module, this option becomes available. Selecting this option will display the appropriate level adjustment screens and/or the calibration screens. If the level is adjusted, an adjusted level event is logged. If a parameter is calibrated, an appropriate event is logged.  
Calibrating a parameter probe will temporarily “turn off” the partition data storage and the sample enable/disable functions. These functions are disabled during the calibration and for five minutes after the program is resumed. During this time, parameter data normally collected at the data storage interval will be logged as a 252 error message.
- 4.8.8 Adjust Pacing** This option is available when the running program is paced by Time, Flow Pulses or Flow Volume. If you select this option, you are asked to enter a new pacing interval. The sampler logs an interval changed event.  
The original pacing interval continues to count down until you return the sampler to the running program (select resume program). If the new pacing interval is less than the original count remaining, the new interval is used.  
If the original count remaining is less than the new pacing interval, the original count will continue to count down to the next sample event. Subsequent samples are then paced by the new interval.



#### 4.8.9 Adjust Volume

Select this option to change the sample volume within the limits of the currently programmed sample distribution. If you change a sample volume, a volume changed event is logged.

#### 4.8.10 Power Used

The 6712FR has a “fuel gauge” that gives an indication of power usage. The controller keeps track of how much power has been consumed since the last time it lost power. If the controller is powered by an external battery, this fuel gauge can help you estimate the condition of the battery.

Keep in mind that the sampler has no idea as to how much charge was originally stored in the battery (or even if a battery is being used), and therefore has no idea as to the *remaining capacity* of its power source.

### 4.9 Other Functions

#### Other Functions Menu

RUN PROGRAM  
VIEW REPORT  
OTHER FUNCTIONS

- Select OTHER FUNCTIONS.

MAINTENANCE  
MANUAL FUNCTIONS  
PROGRAMMING STYLE

In Standard Programming, the “Other Functions” menu screen includes options for:

- Maintenance (see Section 7).
- Manual Functions (see below).
- Programming Style (see Section 3).

#### 4.10 Manual Functions

The manual functions programming screens let you:

- Take grab samples.
- Calibrate sample volumes.
- Operate the pump manually.
- Move the distributor arm.

#### 4.11 Grab Samples

Grab samples let you take a single sample on demand, collecting the sample in an external container (Figure 4-4). Keep in mind:

When the sampler delivers a grab sample, it runs through a complete sampling cycle, using the current settings for volume and for line rinses or retries. If it is a two-part program, the sampler uses the settings for part A.

To take a grab sample while the sampler is running a program, you must interrupt the program by pressing the Stop key. Restart the program by running it again.

##### To take a grab sample:

1. Disconnect the pump tube from the bulkhead fitting.
2. Place the end of the tube over a collection container.
3. Follow the steps in *Taking a Grab Sample* at left.
4. Reconnect the pump tube to the bulkhead fitting.

### Taking a Grab Sample

- 1 

GRAB SAMPLE  
CALIBRATE VOLUME  
OPERATE PUMP  
MOVE DISTRIBUTOR

  - Select GRAB SAMPLE
- 2 

SAMPLE VOLUME:  
\_\_\_ ml (10-9990)

  - Enter the desired volume
- 3 

GRAB SAMPLE  
PRESS ↵ WHEN READY!
- 4 

PURGING  
SUCTION LINE
- 5 

PUMPING 200 ml
- 6 

PURGING  
SUCTION LINE
- 7 

GRAB SAMPLE  
CALIBRATE VOLUME  
OPERATE PUMP  
MOVE DISTRIBUTOR

  - Press STOP to return to main menu.



Figure 4-4 Taking a Grab Sample

### 4.12 Calibrate Volume

The sampler delivers accurate sample volumes without calibration. If you find that sample volumes vary significantly from the programmed values, first check the suction line for proper installation. Be sure it slopes continuously downhill to the liquid source and drains completely after each sampling cycle. Then, compare the actual length of the suction line to the suction line length settings in the program to see that they match. Also check the pump tube for excessive wear and replace it if necessary.

You may want to calibrate when:

- A new pump tube is installed. Run the pump for five minutes before calibrating.
- The sample source is above the sampler.
- Sampling from pressurized lines (15 PSI Maximum).

#### 4.12.1 Calibration Tips

- For the best results, calibrate the sampler after it's installed on site.
- Use a graduated cylinder for volume measurement.
- The sampler clears the previous calibration setting when you reinitialize the sampler.
- You cannot calibrate while the sampler is running a program.
- When the sampler delivers the sample, it runs through a complete sampling cycle, using the current settings for volume line rinses and retries. If it is a two part program, the sampler uses the volume setting for part A.

#### Calibrating Sample Volumes

1

RUN PROGRAM VIEW REPORT OTHER FUNCTIONS
--

- Select OTHER FUNCTIONS

2

MAINTENANCE MANUAL FUNCTIONS MODULE HARDWARE
---

- Select MANUAL FUNCTIONS

3

GRAB SAMPLE CALIBRATE VOLUME OPERATE PUMP MOVE DISTRIBUTOR
---

- Select CALIBRATE VOLUME

4

SAMPLE VOLUME: ___ ml (100-9990)
-------------------------------------

- Enter the desired volume

5

CALIBRATE VOLUME PRESS ↵ WHEN READY!
---

6

PURGING SUCTION LINE
-------------------------

7

PUMPING 200 ml
----------------

8

PURGING SUCTION LINE
-------------------------

9

VOLUME DELIVERED: ___ ml
-----------------------------

- Measure the volume delivered and enter the amount here.

10

200 ml ARE YOU SURE? YES NO
-----------------------------------

This screen appears when the amount you entered in step 9 was more than twice, or less than half, the programmed volume.

- Select YES when the volume delivered matches the volume displayed on this screen.
- Select NO to enter the volume delivered.

To calibrate:

1. Disconnect the pump tube from the bulkhead fitting.
2. Place the end of the tube over a collection container.
3. Follow the steps in Calibrating Sample Volumes in the margin.

Reconnect the pump tube to the bulkhead fitting.

## 4.13 Operating the Pump

### Operating the Pump

GRAB SAMPLE  
CALIBRATE VOLUME  
**OPERATE PUMP**  
MOVE DISTRIBUTOR

SELECT DIRECTION  
PUMP FORWARD  
PUMP REVERSE

PURGING. . .  
PRESS THE RED 'STOP'  
KEY WHEN DONE

PURGED \_\_\_\_ COUNTS

You can manually operate the sampler's pump in the forward or reverse direction. You can do this to test the pump, draw a large sample, or purge the suction line.

When you run the pump manually, the sampler reports the number of pump counts during the pump's operation. Use this feature to obtain an estimate of the pump counts required to purge a nonstandard suction line.

You can also manually run the pump from the main menu. Press the "1" key and then ↵ to run the pump in reverse. Press the "3" key and then ↵ to run the pump forward.

### CAUTION

Tests indicate that the pump produces sound levels in excess of 85db at one meter. PROLONGED EXPOSURE TO THIS SOUND LEVEL COULD RESULT IN HEARING LOSS AND REQUIRES THE USE OF PROTECTIVE EAR PLUGS.

## 4.14 Moving the Distributor Arm

### Moving the Distributor Arm

GRAB SAMPLE  
CALIBRATE VOLUME  
OPERATE PUMP  
**MOVE DISTRIBUTOR**

- Select MOVE DISTRIBUTOR

GO TO BOTTLE \_\_\_\_  
(1-MAX)

- Enter the bottle number to which you want to move the distributor

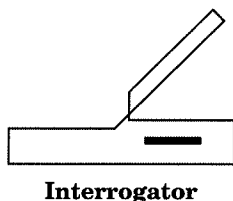
NOW AT BOTTLE \_\_\_\_

The sampler lets you reposition the distributor arm. Use this feature to verify a bottle location when installing a bottle kit. You cannot move the distributor arm while the sampler is running a program.

### CAUTION

DO NOT rotate the distributor arm manually; this will severely damage the distributor drive gears.

## 4.15 Reports



The 6712 records a variety of data while running a sampling program. It uses the data to produce four reports:

- The Program Settings report, listing the program settings.
- The Sampling Results report, listing the program settings, time of samples and other program events.
- The Combined Results report, combining the sample event times with rainfall or module data.
- The Summary report, listing daily summaries of data collected. The Summary report may be rainfall and/or module data.

The sampler stores the data for each report in memory where they remain until you select RUN. Selecting RUN clears the memory so that it can store the data from the next program.

### 4.15.1 Collecting Reports



There are a number of ways to collect the reports:

View reports (program settings, sampling results, and abbreviated summary reports) on the sampler's display.

Collect the reports (except for summary reports) with an Isco 581 RTD and use a computer running Flowlink to transfer the reports from the RTD to a file on the computer.

#### ☒ **Note**

The RTD is not compatible with samplers running software version 2.50. Refer to Section 1.4.5 for complete information.

Collect the reports (except for summary reports) with a computer running Flowlink.

### 4.15.2 Viewing the Data

Because the display area is small, the data on the reports will be displayed a little differently from the data that is transferred to and viewed on your computer.

- For the Sampling Report, the sampler displays each program event, one at a time.
- For the Module and Rainfall Data reports, it displays daily summaries, instead of the full reports available with the rtd, Flowlink.

If you select Sampling Report or Rainfall (step 3 in *Viewing Data*, shown in the margin), the sampler begins displaying the report data. The sampler advances automatically through the report items, displaying each item briefly. While the sampler advances automatically through the displays:

- Stop the automatic displays by pressing Stop once. Then, use the arrow keys to move manually through the report.

- Viewing Data**
- 1 

RUN  
PROGRAM  
**VIEW REPORT**  
OTHER FUCTIONS

    - Select VIEW REPORT.
  - 2 

**VIEW DATA**  
SYSTEM IDs  
CONFIGURE REPORTS

    - Select VIEW DATA.
  - 3 

SELECT DATA TO VIEW:  
SAMPLING REPORT  
**MODULE DATA**  
RAINFALL DATA

    - Select a report or data type.
  - 4 

VIEW:  
DAILY SUMMARY  
CURRENT READINGS

    - Select DAILY SUMMARY to view the stored data, or CURRENT READINGS to view real-time data.

#### 4.15.3 Configuring Reports

- 1 

RUN  
PROGRAM  
**VIEW REPORT**  
OTHER FUCTIONS

  - Select VIEW REPORT.
- 2 

VIEW DATA  
SYSTEM IDs  
**CONFIGURE REPORTS**

  - Select CONFIGURE REPORTS
- 3 

FLOWLINK REPORT  
CUSTOM REPORT  
ALL REPORTS

  - Select the option that matches your data collection software, or tailor the output according to the reports needed.

- Return to the main menu by pressing Stop twice.

At the end of the report, the sampler leaves the last item displayed until you press:

- the arrow keys to move forward or backward manually through the report.
- Stop to return to the main menu.
- ↵ to start the automatic displays again.

If you select Module Data in step 3, the sampler displays the screen shown in step 4. Select the Daily Summary option and the sampler displays the stored data just as the Sampling Report was described above. Selecting the current readings option causes the sampler to display real-time readings. When there are multiple screens, they will be displayed alternately. You can quickly advance through the screens by pressing an arrow key or ↵. Pressing Stop exits the Current Readings mode.

The Configure Reports option lets you specify which of the Sampling Reports will be included in any output request. Each sampler is shipped with the option Flowlink report selected.

The Flowlink Report options allow you to tailor the output to the Isco software used to collect the reports.

Flowlink Report provides the Sampling Reports and the detailed partition data. Selecting the Flowlink Report option enables the output of the detailed partition data so Flowlink can add the data to the site's database file.

When you are familiar with the available Sampling Reports, you may want to specify an output containing only the specific data you require. The Custom Report option will allow selection of detailed data. Data collection time and storage space may be optimized using this option.

#### 4.15.4 Sampling Results Report

As the sampler runs a program, it records the program's events. Program events include such items as sample events, program enables and disables, power losses, and so on. Table 4-3 lists each event with a short description. You can view the report by following the steps in *Viewing the Data* on page 4-18 or print the log as the Sampling Results report.

In the text file version of the report, sample-event entries include the time of the event as well as the sample and bottle numbers.

The sample column contains the sample number deposited into the bottle. This information reflects the distribution selected for the program.

The letters in the Source columns are codes for the cause of the event. The letters in the Error column are codes for the causes of missed samples. The source and error codes appear with explanations at the end of the report. A list of codes appears in Table 4-3.

The last column in the Sampling Results report records the pump counts for the sample event. Large variations in pump counts from event to event indicate fluctuating heads, a relocated suction line, or a temporarily clogged strainer.

#### 4.15.5 Combined Results Report

At the time of each sample event, the sampler records the readings from each connected module, rain gauge, or SDI-12 sonde. The Combined Results Report presents the event time, sample and bottle number, and the respective readings from the device.

For flow modules, the readings are level and flow rate. For the pH module, the readings are temperature and pH. For the rain gauge and SDI-12 Sonde, the readings vary according to the selections enabled during the hardware setup in extended programming. When recording four or more sonde parameters, the Combined Results report will exceed the standard 40 character width. To read the additional columns, the data must be collected with Flowlink 5.1 for Windows software.

#### 4.15.6 Summary Report

This report summarizes the rain gauge or module data. The types of readings are the same as those available to the Combined reports. The sampler compiles the data to present a daily total, the day's average, maximum, and minimum reading, and a listing of hourly averages. The sampler then graphs the day's readings.

**Table 4-3 Reports: Program Events, Source Codes, and Error Codes**

* Indicates events and codes that occur in Standard Programming	
Program Events (listed in the order that they most likely would occur)	
*Program Run	The sampler ran the sampling program.
*Program Started	The sampler started the sampling program.
*Program Enabled (Disabled)	The sampler was enabled or disabled according to program settings or an external instrument.
'A'/'B' Enabled (Disabled)	Program part 'A' or 'B' was enabled or disabled according to the program's settings.
Sample	A sample was taken as programmed. (See Source Codes and Error Codes in this table.)
*Sample Switch Time	A sample was taken at programmed switch time.
*Program Done	The sampler finished the sampling program.
'A'/'B' Done	The sampler finished program part 'A' or 'B'.
*Manual Pause	Stop was pressed during the program to enter the Manual Paused state.
*Program Stopped	You selected Stop from the manual paused options, terminating the program.
*Grab Sample	A grab sample was taken while in the Manual Paused state.
Pump Tube Replaced	The pump tube alarm was reset while in the Manual Paused state.
Calibrate Volume	The volume was calibrated.
Calibrate SDI Parameter	An SDI-12 sonde or module parameter was calibrated.
*Adjusted Pacing	The pacing interval was changed while in the Manual Paused state.
*Volume Changed	Sample volume was changed while in the Manual Paused state.
Adjust Enable	Sampler enable thresholds were changed while in the Manual Paused state.
Reset Rain History	The rain history was reset.
Adjust Suction Head	The suction head was changed while in the Manual Paused state.
*Manual Resume	The resume program option was selected from the Manual Paused state.
Program Paused (Resumed)	The program reached a programmed pause or resume time.
'A'/'B' Paused (Resumed)	Program part 'A' or 'B' reached a programmed pause or resume time.
*Power Failed	The power source was disconnected.
*Power Restored	The power source was reconnected.
Alarm Occurred	An alarm occurred.
Alarm Acknowledged	An alarm was acknowledged.
*Missed Password	The password was missed.



**Table 4-3 Reports: Program Events, Source Codes, and Error Codes (Continued)**

(The Source and Error Codes Listed below refer to why a sample was taken and what happened while it was being taken.)

Source Codes		
*C	Calibrate sample	Sample volume delivered during calibration.
*D	Disable	Sample event at disable time.
*E	Enable	Sample event at enable time.
Ev	Event	Event-paced sample event.
*F	Flow	Flow-paced sample event.
*G	Grab sample	Sample volume delivered as a grab sample.
M	Command driven sample	A command driven sample.
PH	Phone command	Phone command sample.
R	Resume	Sample event at resume time.
*S	Start	Sample event at start time.
Sw	Switch time	Sample event at switch time.
TO	Time Override	Sample event at bottle-switch time.
*T	time	Time-paced sample event.
Error Codes		
*DJ	Distributor Jammed	The distributor jammed.
*IP	sample in progress	Sample in progress when report was printing.
*L	pump latch open	Unable to take sample because the pump band was opened.
*ND	no distributor arm	There is no distributor arm or the stop is damaged.
*NL	No Liquid Detected	The sampler was unable to detect liquid.
LF	Not enough flow	Not enough flow for the minimum sample volume entered for samples with volumes proportional to flow.
*NM	No More Liquid	After the sampler detected liquid and while the sample was being taken, the liquid detector stopped detecting liquid.
M	Bottle Full	The composite bottle is full.
*O	Sampler Shut Off	The sampler was turned off with the On-Off key during the sample event.
Ov	Probable Overflow	The sampler was directed to take a sample that would not fit into the bottle. Occurs for flow paced, time override programs only.
*P	Power Failed	The power supply failed during the sample event. Note: Power failures during five consecutive sample events results in a LOW BATTERY shut-down.
*PJ	Pump Jammed	The pump jammed.
*Sk	Sample Skipped	Sample not taken.
*US	User Stopped	You pressed the Stop key during the sample event.

Figures 4-5, 4-6, 4-7, 4-8, and 4-9 show examples of reports configured to show program settings, sampling results, combined results, and a summary report.

SAMPLER ID# 3687447734 06:32 19-DEC-02  
Hardware: A0 Software: 1.02  
\*\*\*\*\* PROGRAM SETTINGS \*\*\*\*\*

-----  
SITE DESCRIPTION:  
"FACTORY051"

-----  
UNITS SELECTED:  
FLOW RATE: cfs  
FLOW VOLUME: Mgal

-----  
BUBBLER MODULE:  
WEIR  
90  
V-NOTCH  
-----  
24, 1000 ml BTLS  
  
10 ft SUCTION LINE

-----  
PACING:  
TIME, EVERY  
0 HOURS, 15 MINUTES

-----  
DISTRIBUTION:  
SEQUENTIAL

-----  
200 ml SAMPLES

-----  
5 MINUTE DELAY TO  
FIRST SAMPLE  
  
-----

*Figure 4-5 Report: Program Settings*

6712FR Refrigerated Sampler  
Section 4 Standard Programming

---

SAMPLER ID# 3687447734 06:32 19-DEC-02  
Hardware: A0 Software: 1.02  
\*\*\*\*\* SAMPLING RESULTS \*\*\*\*\*  
SITE: FACTORY051  
Program Started at 15:03 WE 18-DEC-02  
Nominal Sample Volume = 200 ml

SAMPLE	BOTTLE	TIME	SOURCE ERROR	COUNT TO LIQUID
-----	-----	----	-- --	-----
		15:03	PGM ENABLED	
1,1	1	15:03	S	250
1,1	2	15:18	T	247
1,1	3	15:33	T	247
1,1	4	15:48	T	249
1,1	5	16:03	T	247
1,1	6	16:18	T	247
1,1	7	16:33	T	247
1,1	8	16:48	T	248
1,1	9	17:03	T	237
1,1	10	17:18	T	236
1,1	11	17:33	T	237
1,1	12	17:48	T	241
1,1	13	18:03	T	238
1,1	14	18:18	T	236
1,1	15	18:33	T	237
1,1	16	18:48	T	236
1,1	17	19:03	T	242
1,1	18	19:18	T	237
1,1	19	19:33	T	235
1,1	20	19:48	T	238
1,1	21	20:03	T	237
1,1	22	20:18	T	237
1,1	23	20:33	T	236
1,1	24	20:48	T	230
		20:48	PGM DONE 19-DEC	

SOURCE S ==> START  
SOURCE T ==> TIME  
-----

Figure 4-6 Report: Sampling Results

SAMPLER ID# 3687447734 06:32 19-DEC-02  
Hardware: A0 Software: 1.02  
BUBBLER MODULE: 2215419583  
Hardware: A00000 Software: 1.07  
\*\*\*\*\* COMBINED RESULTS \*\*\*\*\*  
SITE: FACTORY051  
Program Started at 15:03 WE 18-DEC-02  
Nominal Sample Volume = 200 ml

SAMPLE	BOTTLE	TIME	LEVEL ft	FLOW RATE cfs	TOTAL FLOW Mgal
1,1	1	15:03	0.009	2.495	000000.000
1,1	2	15:18	0.012	2.576	000000.017
1,1	3	15:33	0.012	2.666	000000.035
1,1	4	15:48	0.012	2.773	000000.053
1,1	5	16:03	0.012	2.773	000000.072
1,1	6	16:18	0.012	2.798	000000.091
1,1	7	16:33	0.012	2.798	000000.109
1,1	8	16:48	0.012	2.798	000000.128
1,1	9	17:03	0.012	2.751	000000.147
1,1	10	17:18	0.012	2.773	000000.166
1,1	11	17:33	0.009	2.798	000000.185
1,1	12	17:48	0.012	3.728	000000.207
1,1	13	18:03	0.012	3.728	000000.232
1,1	14	18:18	0.012	3.728	000000.257
1,1	15	18:33	0.009	3.728	000000.282
1,1	16	18:48	0.012	5.273	000000.317
1,1	17	19:03	0.012	5.239	000000.353
1,1	18	19:18	0.012	6.651	000000.397
1,1	19	19:33	0.009	6.651	000000.442
1,1	20	19:48	0.009	6.651	000000.486
1,1	21	20:03	0.012	6.651	000000.531
1,1	22	20:18	0.012	6.651	000000.576
1,1	23	20:33	0.009	3.404	000000.612
1,1	24	20:48	0.012	3.425	000000.634

Figure 4-7 Report: Combined Results

*6712FR Refrigerated Sampler*  
*Section 4 Standard Programming*

---

```
SAMPLER ID# 3687447734 06:32 19-DEC-02
Hardware: A0      Software: 1.02
***** COMBINED RESULTS *****
SITE: FACTORY051
Program Started at 15:03 WE 18-DEC-02
Nominal Sample Volume = 200 ml
                        FR-TEMP
SAMPLE  BOTTLE TIME      C
-----
                        NO FR-TEMPERATURE
-----
```

```
SAMPLER ID# 3687447734 06:32 19-DEC-02
Hardware: A0      Software: 0.01.0127
***** COMBINED RESULTS *****
SITE: FACTORY051
Program Started at 15:03 WE 18-DEC-02
Nominal Sample Volume = 200 ml
SAMPLE  BOTTLE TIME
-----
                        NO RAIN GAUGE
-----
```

```
SAMPLER ID# 3687447734 06:32 19-DEC-02
Hardware: A0      Software: 0.01.0127
SDI-12 DATA
***** COMBINED RESULTS *****
SITE: FACTORY051
Program Started at 15:03 WE 18-DEC-02
Nominal Sample Volume = 200 ml

                        NO SDI-12 SONDE
-----
```

*Figure 4-8 Report: Combined Results (continued)*

SAMPLER ID# 3687447734 16:41 20-DEC-02  
Hardware: A0 Software: 1.02  
BUBBLER MODULE: 2215419583  
Hardware: A00000 Software: 1.07  
SITE: FACTORY051

Summary Report for 19-DEC-02 (TH)  
Day's Flow: 000000.054 Mgal  
Average Flow Rate: 0.4437 cfs  
07:20 Minimum Flow Rate: 0.0237 cfs  
13:25 Maximum Flow Rate: 7.0207 cfs  
Hourly Average Flow Rate:  
00:00-01:00: NO DATA  
01:00-02:00: NO DATA  
02:00-03:00: NO DATA  
03:00-04:00: NO DATA  
04:00-05:00: NO DATA  
05:00-06:00: NO DATA  
06:00-07:00: NO DATA  
07:00-08:00: NO DATA  
08:00-09:00: 2.519 cfs  
09:00-10:00: 2.747 cfs  
10:00-11:00: 2.791 cfs  
11:00-12:00: 3.456 cfs  
12:00-13:00: 5.385 cfs  
13:00-14:00: 6.651 cfs  
14:00-15:00: 2.591 cfs  
15:00-16:00: 1.593 cfs  
16:00-17:00: NO DATA  
17:00-18:00: NO DATA  
18:00-19:00: NO DATA  
19:00-20:00: NO DATA  
20:00-21:00: NO DATA  
21:00-22:00: NO DATA  
22:00-23:00: NO DATA  
23:00-24:00: NO DATA

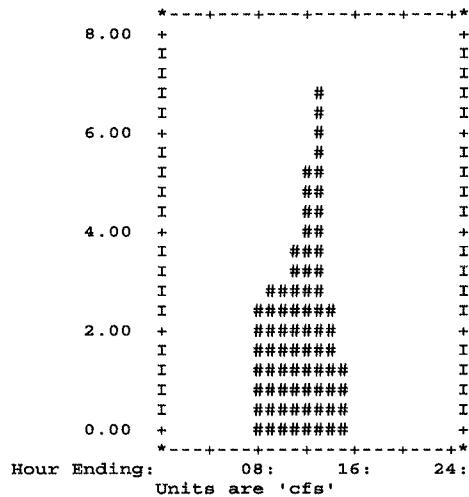


Figure 4-9 Report: Summary

## 4.16 System IDs

### System IDs

RUN PROGRAM <b>VIEW REPORT</b> OTHER FUNCTIONS
---

- Select VIEW REPORT.

VIEW DATA <b>SYSTEM IDs</b> CONFIGURE REPORTS
---

- Select SYSTEM IDs.

SAMPLER 6712 ID _____ HARDWARE: ____ SOFTWARE: ____
--

- Displayed briefly

[MODULE TYPE] [MODEL #] ID: _____ HARDWARE: ____ SOFTWARE: ____
--

- Displayed briefly

SOFTWARE OPTIONS  [Options List]
--

- Press STOP to return to the main menu.

In addition to viewing report data and configuring reports, the View Report option on the main menu lets you view system identification information.

The sampler reports the sampler model number, ID (identification number), and software version number as system identification notes. The sampler also reports the same information for an attached module.

The model and ID numbers remain unchanged through the life of the sampler. The ID numbers appear on the sampler's reports and in files created by Flowlink and when they interrogate the sampler. The software packages use the ID number to make sure that data from different samplers is not combined in the same file.

The software version number changes when your sampler's software is updated.

The system will also list any software options that you have activated on your unit. These software options are discussed in Section 5.

## 4.17 Programming for 700 Series Modules

The bay on the controller's side accepts any of Teledyne Isco's 700 Series Modules. These modules are optional accessories that are not required for operation of the 6712. However, the modules offer an economical way to combine flow-rate or parameter monitoring with sampling.

The programming of these modules is integrated with the programming of the sampler, so attachment of a module will cause different screens to be displayed, depending on the type of module and the selections you make while programming.

Two modules that are commonly used are the 730 Bubbler Module, which monitors a flow stream's level and flow rate, and the 750 Area Velocity Module for monitoring a flow stream's level, velocity, and flow rate. The following sets of screens give you an example of what screens you might see while programming the sampler and module. Refer to Table 4-1 (which does not have a module attached) at the beginning of this section to compare the sequence of screen displays.



## CAUTION

Most Isco accessories and interfacing equipment are not certified for use in hazardous locations as defined by the National Electrical Code. Check applicable guidelines, codes, and regulations of federal, state, city, and county agencies. Refer to Appendix C in the back of this manual for more safety information.

**Table 4-4 Programming Example With 730 Module Installed**

1	MODULE INSERTED--- DOWNLOAD DATA NOW OR LOSE ALL DATA! DONE	With the sampler off, insert the module in the bay on the controller. Turn the sampler on by pressing the On/Off key. Press ↵. Download stored data, if you want to keep it. Pressing DONE erases it and advances to the next screen.
2	6712 SAMPLER STANDARD PROGRAMMING For HELP at any screen press ? key.	This screen will now appear for 8 seconds.
3	RUN PROGRAM VIEW REPORT OTHER FUNCTIONS	The option PROGRAM will be blinking. Press ↵.
4	SITE DESCRIPTION: "FACTORY051" CHANGE? YES NO	The option NO will be blinking. Press ↵. For the purposes of this example, it isn't necessary to change the description.
5	SELECT UNITS FOR FLOW RATE: cfs gps gpm Mgd lps m3s m3h m3d	Select the desired units for the flow rate. For this example, choose cfs. Press ↵.
6	SELECT UNITS FOR FLOW VOLUME: cf gal Mgal m3 lit	Select the desired units for the flow volume. For this example, choose Mgal. Press ↵.
7	PROGRAM MODULE? YES NO	Select YES to program the module.
8	MODE OF OPERATION: FLOWMETER LEVEL ONLY	If you choose Flowmeter, proceed to screen #9 below. If you choose LEVEL ONLY, proceed to screen #12.
9	WEIR FLUME DATA POINTS EQUATION MANNING FLOW-INSERT	When you select Flowmeter, you will have several options for performing the flow conversion. For this example, choose Weir. Press ↵.



**Table 4-4 Programming Example With 730 Module Installed (Continued)**

10	V-NOTCH RECTANGULAR CIPOLLETTI	For this example, choose V-Notch. Press ↵.
11	V-NOTCH WEIR ANGLE: 120 90 60 45 30 22.5	For this example, choose a Weir angle of 90. Press ↵.
12	CURRENT LEVEL IS ____ ft ADJUST LEVEL TO ____ ft	The current level will be displayed. Enter an adjustment if needed. If the adjustment is different by more than 0.50 ft, you will be prompted "ARE YOU SURE? YES NO" Choose NO to re-enter; select YES if correct. Press ↵.
13	NUMBER OF BOTTLES: 1 2 4 8 12 24	Select the number of bottles in your bottle kit by pressing either arrow key until the correct number blinks. Press ↵. For this example, select 24.
14	BOTTLE VOLUME IS 1000 ml (300-30000)	Type the volume for the bottles in your kit. For this example, 1000 is correct, so simply press ↵.
15	SUCTION LINE LENGTH IS 10 ft (3-99)	Type the length of the suction line, then press ↵. If you change the length, the sampler will display a message, "PLEASE WAIT! . . . GENERATING PUMP TABLES."
16	TIME PACED FLOW PACED	Select FLOW PACED. If the module is being used as a flowmeter, you will see screen #17a. If the module is being used for level only, you will see screen #17b.
17a	FLOW BETWEEN SAMPLE EVENTS: 0.075 Mgal (0.001 - 99999)	If the module is being used as a flowmeter, choose the amount of flow between sample events.
17b	FLOW BETWEEN SAMPLE EVENTS: 2 PULSES (1-9999)	If the module is being used for level only, enter the number of pulses between sample events.
18	SEQUENTIAL BOTTLES/SAMPLE SAMPLES/BOTTLE	Select BOTTLES/SAMPLE.
19	2 BOTTLES PER SAMPLE EVENT (1-24)	Enter 2.
20	RUN CONTINUOUSLY? YES NO	Select NO.
21	SAMPLE VOLUME: 250 ml (10-1000)	Enter 250.

**Table 4-4 Programming Example With 730 Module Installed (Continued)**

22	NO DELAY TO START DELAYED START <b>CLOCK TIME</b> WAIT FOR PHONE CALL	Select <b>CLOCK TIME</b> .
23	START FLOW COUNT AT: 06:00	Enter 6, then enter 0.  This is the time at which the sampler will start the pacing countdown.
24	SELECT DAYS: SU <b>MO</b> TU WE TH FR SA  DONE	Select MO, WE, and FR. Use the arrow keys and ↵ to select MO, WE, and FR. When the correct days are blinking, select DONE and press ↵.
25	PROGRAMMING COMPLETE RUN THIS PROGRAM NOW? YES <b>NO</b>	Select NO.

**Table 4-5 Programming Example With 750 Module Installed**

1	MODULE INSERTED--- DOWNLOAD DATA NOW OR LOSE ALL DATA! DONE	With the sampler off, insert the module in the bay on the controller. Turn the sampler on by pressing the On/Off key. Press ↵. Download stored data, if you want to keep it. Pressing DONE erases it and advances to the next screen.
2	6712 SAMPLER STANDARD PROGRAMMING For HELP at any screen press ? key.	This screen will now appear for 8 seconds.
3	RUN <b>PROGRAM</b> VIEW REPORT OTHER FUNCTIONS	The option <b>PROGRAM</b> will be blinking. Press ↵.
4	SITE DESCRIPTION: "FACTORY051" CHANGE? YES <b>NO</b>	The option NO will be blinking. Press ↵. For the purposes of this example, it isn't necessary to change the description.
5	SELECT UNITS FOR FLOW RATE: <b>cfs</b> gps gpm Mgd lps m3s m3h m3d	Select the desired units for the flow rate. For this example, choose cfs. Press ↵.
6	SELECT UNITS FOR FLOW VOLUME: cf gal <b>Mgal</b> m3 lit	Select the desired units for the flow volume. For this example, choose Mgal. Press ↵.
7	SELECT UNITS FOR VELOCITY: <b>fps</b> mps	Select the desired units for the flow velocity. For this example, choose fps. Press ↵.

**Table 4-5 Programming Example With 750 Module Installed (Continued)**

8	PROGRAM MODULE? <b>YES NO</b>	Select YES to program the module.
9	MODE OF OPERATION: <b>FLOWMETER</b> LEVEL AND VELOCITY	The 750 can have two different modes of operation: Flowmeter or Level and Velocity. For this example, choose Flowmeter. Press ↵.
10	FLOW CALCULATION: <b>AREA * VELOCITY</b> LEVEL TO FLOW RATE	When you select Flowmeter, you will have two options for performing the flow conversion: Area * Velocity or Level to Flow Rate. For this example, choose Area * Velocity. Press ↵.
11	LEVEL TO AREA: <b>CHANNEL SHAPE</b> DATA POINTS	For this example, choose Channel Shape. Press ↵.
12	<b>ROUND PIPE</b> U-CHANNEL RECTANGULAR CHANNEL TRAPEZOIDAL CHANNEL	For the channel shape, select Round Pipe. Press ↵.
13	ROUND PIPE DIAMETER = 2.00 ft	Enter the diameter of the round pipe. Press ↵.
14	CURRENT LEVEL IS ____ ft ADJUST LEVEL TO ____ ft	The current level will be displayed. Enter an adjustment if needed. If the adjustment is different by more than 0.50 ft, you will be prompted "ARE YOU SURE? YES NO" Choose NO to re-enter; select YES if correct. Press ↵.
15	ZERO LEVEL OFFSET: ____ ft	Enter the amount of zero level offset. Press ↵.
16	MAXIMUM DEPTH FOR VELOCITY MEASUREMENT 2" 3" 4"	(This screen is applicable for standard-sized probes only.) Select the maximum depth for the velocity measurement. Press ↵.
17	NUMBER OF BOTTLES: 1 2 4 8 12 24	Select the number of bottles in your bottle kit by pressing either arrow key until the correct number blinks. Press ↵.

From this point forward, the screens will be the same as in Table 4-2.

## **APPENDIX F**

### **Greyline TTFM 1.0 Catalog Cut**

# Transit Time Flow Meter

## with Clamp-on Ultrasonic Transducers

***New!***

### ***Ultrasonic Flowmeter***

#### ***Model TTFM 1.0***

Displays, Totalizes  
Transmits and Controls

Backlit LCD Display  
Simple 5-key Calibration  
Password Protected  
4-20mA/0-5V Output  
Plug & Play Options



#### **Accurate Flow Measurement of Clean Liquids with Non-Contacting Transducers**

#### **Non-Contacting Flow Measurement**

Ultrasonic transducers mount on the outside of plastic or metal pipes to measure flow rate of clean, non-aerated fluids like water, chemicals, and oils. The clamp-on transducers can be mounted without shutting down flow. There is no pressure drop and no obstruction. Transducer separation distance is calculated by the flowmeter according to pipe diameter and wall thickness.

#### **User-Friendly Operating System**

Use the built-in keypad for fast, easy calibration with menu selection of pipe diameter, pipe material, liquid type and measurement units (gallons, liters etc.) Settings, calibration values and totalizer are retained during power interruptions.

***GREYLINE***  
***instruments inc.***

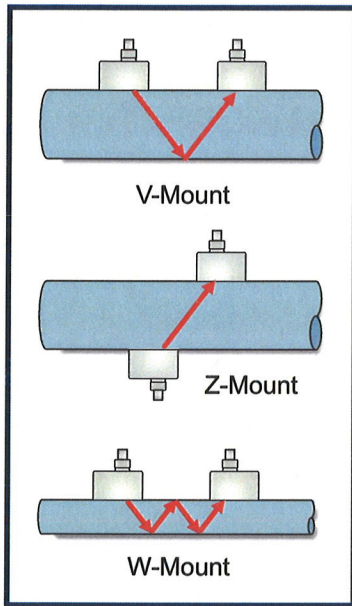
RELIABLE MEASUREMENT AND CONTROL

[www.greyline.com](http://www.greyline.com)

00014306



# Transit Time Flowmeter with Clamp-on Ultrasonic Transducers



## ***Measures Flow from the Outside of Metal and Plastic Pipes***

The TTFM 1.0 Transit Time Flowmeter works by measuring the “transit time” or “time of flight” for ultrasonic sound pulses transmitted from one transducer to another. Depending on the mounting configuration, the signal may cross the pipe once, twice or four times. The time between transmitted and received signals is precisely measured by the flow meter. Ultrasonic signals are sent upstream and then downstream with the transducers alternating their functions as transmitters/receivers.

The transit time in the direction of flow is always faster than the transit time against the flow. By comparing these differences with precision timing circuits, the TTFM 1.0 is able to accurately calculate the flow rate. Because the ultrasonic signal is forced to cross the pipe, an average of the flow profile is calculated. So compensation for laminar or turbulent flow is automatic.

TTFM 1.0 transducers can be mounted on vertical or horizontal pipes. The pipe must be full. Choice of V, Z or W mounting method depends on the application and pipe diameter. V-Mount is the most common method while Z-Mount is used for larger pipes or weak signal applications and W-Mount for smaller pipes.

## ***Works with Clean Liquids***

The TTFM 1.0 Transit Time Flowmeter is designed for flow measurement of clean, non-aerated liquids in full pipes. High concentrations of solids or gas bubbles (>2% by volume) will attenuate sound and the Transit Time ultrasonic signal may not be able to cross the pipe. A Greyline Doppler-type flow meter is recommended for applications with solids or bubbles (eg. wastewater or slurries).

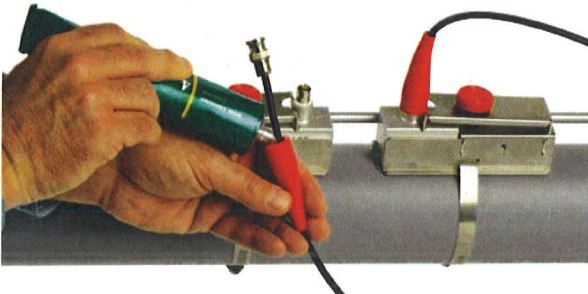
## ***Works from the Outside of Common Pipe Materials***

Mount the TTFM 1.0 ultrasonic transducers on the outside of metal or plastic pipes including carbon steel, stainless steel, ductile iron, cast iron, PVC, PVDF, fiberglass, copper, brass, aluminum and pipes with bonded liners including epoxy, rubber and Teflon. Avoid pipes made with porous materials (e.g. wood or concrete) or with loose insertion liners.



## ***Simple Menu System for Fast, Easy Start-up and Calibration***

Calibration and start-up can be done in a few minutes. Use the built-in 5-button keypad to enter the pipe material and OD, wall thickness and fluid type. The TTFM 1.0 will display the correct transducer separation distance and mounting method. Secure the stainless steel pipe clamps and align the mounting brackets on the outside of the pipe. Put coupling compound (included) on the transducer faces and insert them into the mounting brackets. The TTFM 1.0 will immediately begin to display, transmit and totalize flow.



## ***Transducer Installation in Wet Locations***

The TTFM 1.0 Transit Time Flowmeter transducers are rated for accidental submersion up to 10 psi (0.75 bar). The flowmeter will continue to operate and measure flow accurately during periods of submergence. Plastic seal jackets on the cables can be filled with coupling compound to provide additional moisture protection for the BNC cable connectors.



# TTFM 1.0 Specifications

## General Specifications

<b>Operating Parameters:</b>	For clean liquids in full pipes with less than 2% solids or gas bubbles
<b>Calibration:</b>	built-in 5-key calibrator with English, French or Spanish menu language selection
<b>Electronics Enclosure:</b>	Watertight and dust tight NEMA4X (IP 66) polycarbonate with clear, shatterproof cover
<b>Accuracy:</b>	±1% of flow rate, Repeatability and Linearity: ±0.25%
<b>Display:</b>	White, backlit matrix - displays 5-digit flow rate with floating decimal, 14-digit totalizer, relay status, operating mode and calibration menu
<b>Power Input:</b>	100-240VAC 50-60Hz (see Options), 4.0 Watts maximum (with standard features)
<b>Output:</b>	Isolated 4-20mA/0-5V, 1000 ohm load maximum, programmable offset
<b>Control Relays:</b>	2 Relays, form 'C' dry contacts rated 5 amp SPDT; programmable flow alarm and/or flow proportional pulse
<b>Operating Temp. (electronics):</b>	-5° to 140°F (-20° to 60°C)
<b>Approximate Shipping Weight:</b>	12 lbs. (5.5 kg)

## Greyline TTFM 1.0 Ultrasonic Transit Time Flow Meter

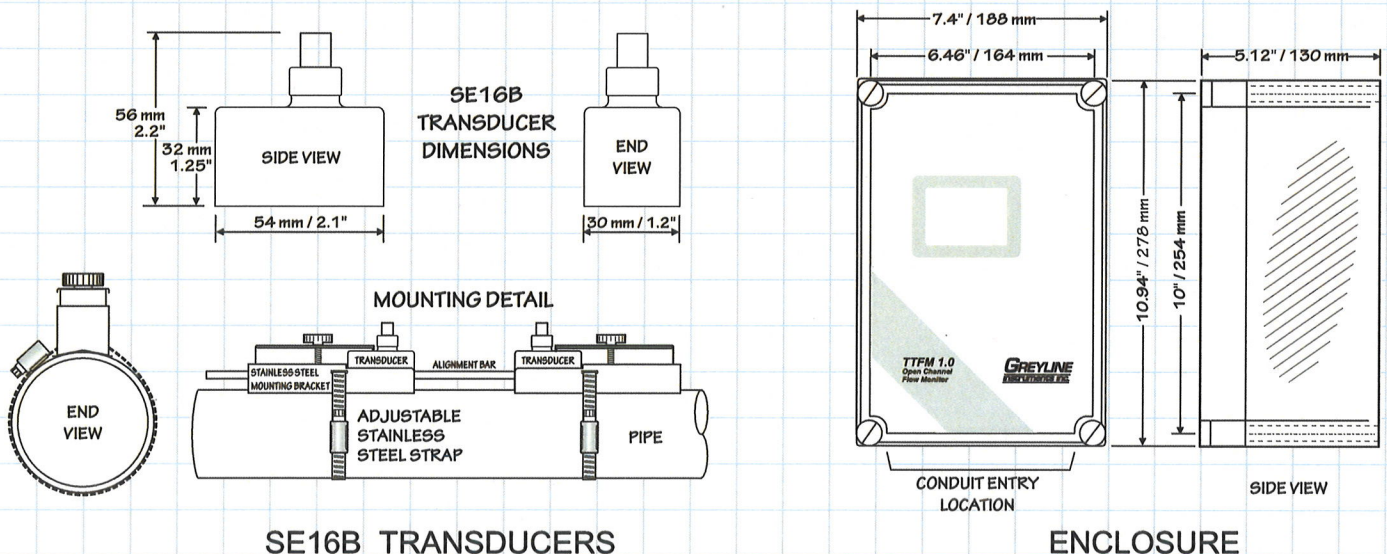
## Transducer Specifications

<b>Pipe Diameter:</b>	½" to 24" (12 mm to 610 mm)
<b>Pipe Materials:</b>	Any metal or plastic sonic conducting material including carbon steel, stainless steel, ductile iron, cast iron, PVC, PVDF, fiberglass, copper, brass, aluminum and pipes with bonded liners including epoxy, rubber and Teflon
<b>Flow Velocity:</b>	±0.07 to 39 ft/sec (±0.02 to 12 m/sec) typical
<b>Operating Frequency:</b>	1.28 MHz
<b>Operating Temperature:</b>	-40° to 300°F (-40° to 150°C)
<b>Transducer Mounting Kit:</b>	Includes set of stainless steel pipe clamps, alignment bar and coupling compound
<b>Sensor Cable:</b>	RG-58 coaxial, 25 ft (7.6 m) with BNC connectors and seal jackets

## Popular Options

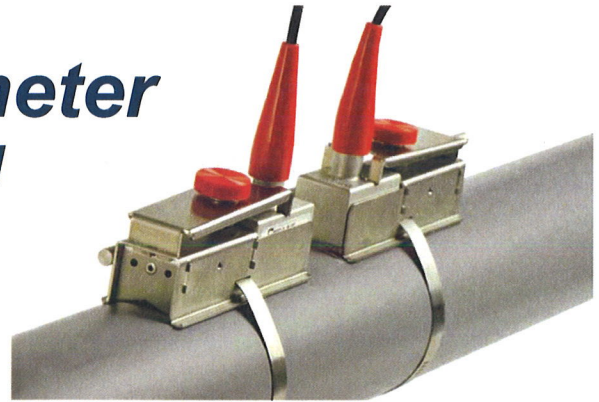
<b>Sensor Cable:</b>	50 ft (15 m) coaxial with BNC connectors and seal jackets or splice up to 250 ft (75 m) shielded coaxial with NEMA4X (IP66) Junction Box
<b>Power Input:</b>	9-32 VDC
<b>Control Relays:</b>	4 additional (6 total), rated 5 amp SPDT
<b>Enclosure Heater:</b>	Thermostatically controlled - recommended for temperatures below 32°F (0°C)
<b>Sunscreen:</b>	Enclosure sunscreen for outdoor installations

## Dimensions





# New Ultrasonic Flowmeter for Clean Liquids in Metal and Plastic Pipes



## Recommended For:

- ♦ potable water
- ♦ river water
- ♦ cooling water
- ♦ demineralized water
- ♦ water/glycol solutions
- ♦ hydraulic oil
- ♦ diesel and fuel oils
- ♦ chemicals

**The TTFM 1.0 Transit Time Flowmeter is ideal to measure flow rate of clean, non-aerated fluids in full pipes. Works best on fluids that have less than 2% particulate or gas bubbles.**

## Easy to Install

Install the TTFM 1.0 Transit Time Flowmeter without cutting the pipe or shutting down flow. It operates on a wide range of metal and plastic pipe sizes and takes just a few minutes to calibrate and start-up.

The flowmeter works by injecting sound through the pipe wall and into the flowing liquid. The transducers transmit ultrasonic signals back and forth. The up and downstream "transit times" are precisely measured and compared to calculate the flow rate. Advanced signal processing software and electronics suppress interference and measure flow with high repeatability and  $\pm 0.5$  to 2% accuracy.



## TTFM 1.0 Advanced Features

Plug-and-play options including a 2-million point data logger and extra control relays can be installed at any time. Power consumption is low (4 Watts typical) with standard AC and optional DC power input. Display backlight brightness is adjustable and 4-20mA output and relays can be disabled to reduce power consumption.

The TTFM ultrasonic transducers are waterproof and designed to operate in wet environments or during accidental submersion. Transducer cable length can be field-extended up to 250 ft (75 m) with optional shielded cable and junction box.

## How to Order

Contact a Greyline sales representative in your area or phone one of our sales engineers. Describe your requirements and receive our prompt quotation.

## Applications Support

Take advantage of Greyline's applications experience. Phone 1-888-473-9546 for advice and information on applications, installation or service for Greyline instruments.

## No Risk Appraisal

The Greyline TTFM 1.0 Transit Time Flow Meter must meet your requirements. Discuss your application with a Greyline representative to arrange a 30-day trial.

## The Greyline Guarantee

Quality of Materials and Workmanship - Each instrument manufactured by Greyline is warranted against defects in materials and workmanship for a period of one year from date of purchase. Refer to our limited warranty included with each product.

**GREYLINE**  
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RELIABLE MEASUREMENT AND CONTROL

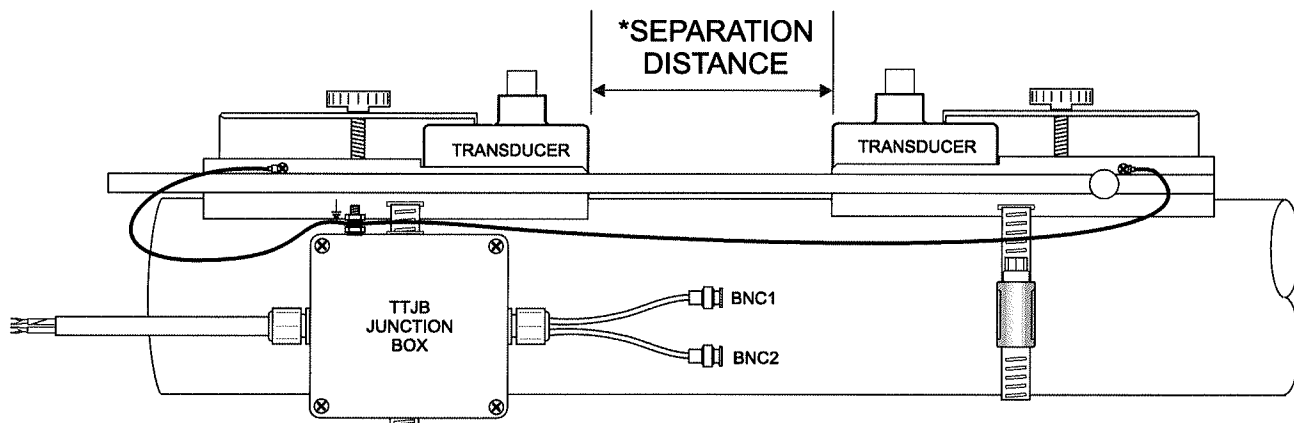
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## **APPENDIX G**

### **Greyline TTFM 1.0 Installation Instructions**

**TRANSDUCER INSTALLATION**



\* Shown in 'Message' display after pipe dimensions are entered.

**CONNECTIONS:**

**POWER INPUT:** The standard model requires AC power input between 100 to 240 VAC 50/60Hz . No adjustments are necessary for voltages within this range. Connect L (Live) N (Neutral) and AC Ground.

Optional DC input model requires 9-32 VDC/9 Watts. Connect to + and - terminals.

Optional Thermostat and Heater modules are available rated for 115 VAC or 230 VAC.

**IMPORTANT NOTE:** To comply with CSA/UL electrical safety standards, AC power input and relay connection wires must have conduit entry to the instrument enclosure. Installation requires a switch, overcurrent fuse or circuit breaker in the building (in close proximity to the equipment) that is marked as the disconnect switch.

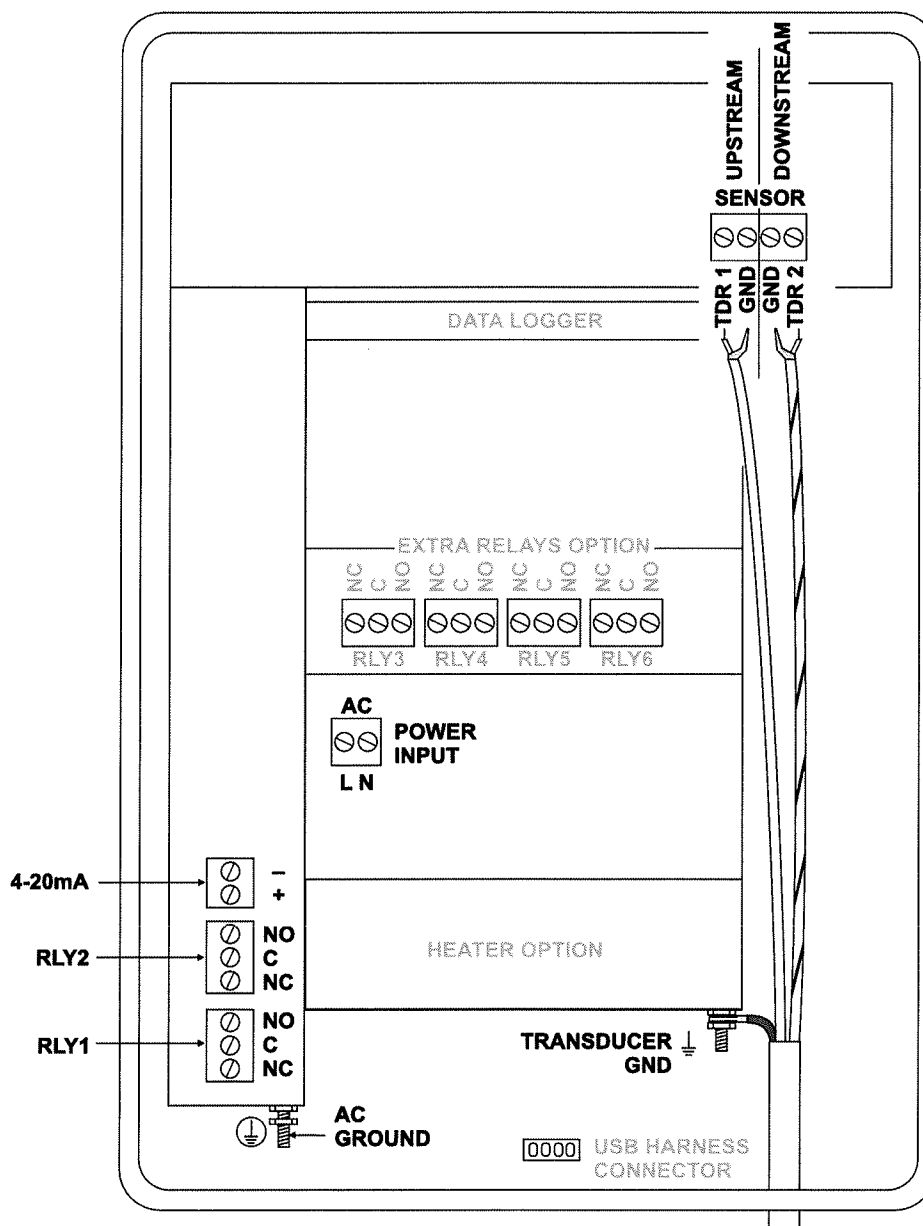


Risk of electric shock. Loosen cover screw to access connections. Only qualified personnel should access connections.

Note: Use of instrumentation over 40°C ambient requires special field wiring.

Note: User replaceable fuse is 2 Amp 250V (T2AL250V), located on the power supply.

## CONNECTIONS



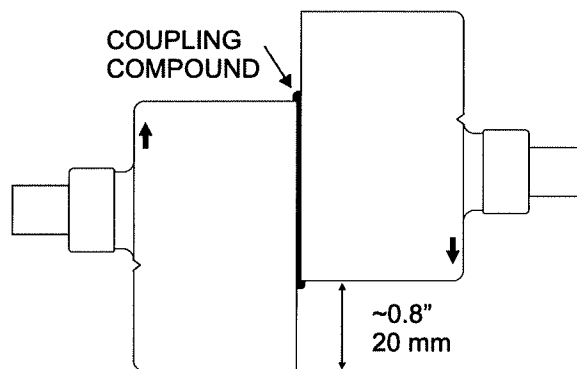
## **QUICK BENCH TEST:**

In the TTFM Calibration menu set parameters to perform a bench test:

- Set Pipe OD = 1.000 inch
- Set Pipe wall = 0.25 inch
- Set Pipe material to ABS
- Press ✓ twice to exit Calibration and return to main display.

From main display press ↓ to view Status menu. Apply coupling compound to the face of transducers and press together as indicated in the illustration below.

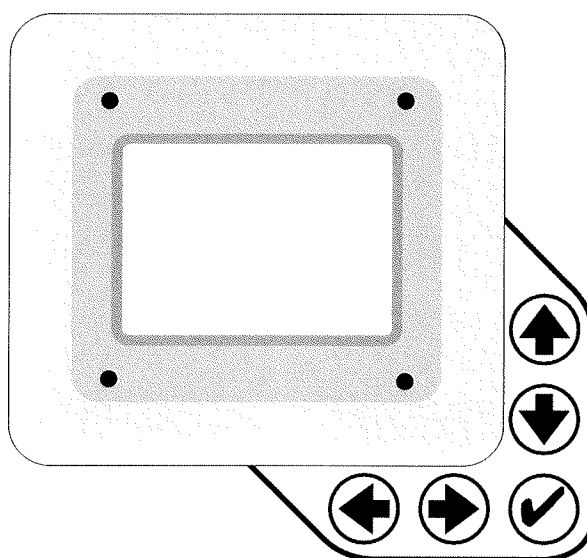
The Status menu should indicate Echo Confidence of 100% and a high Signal Strength (75-100% for TTFM with standard options).



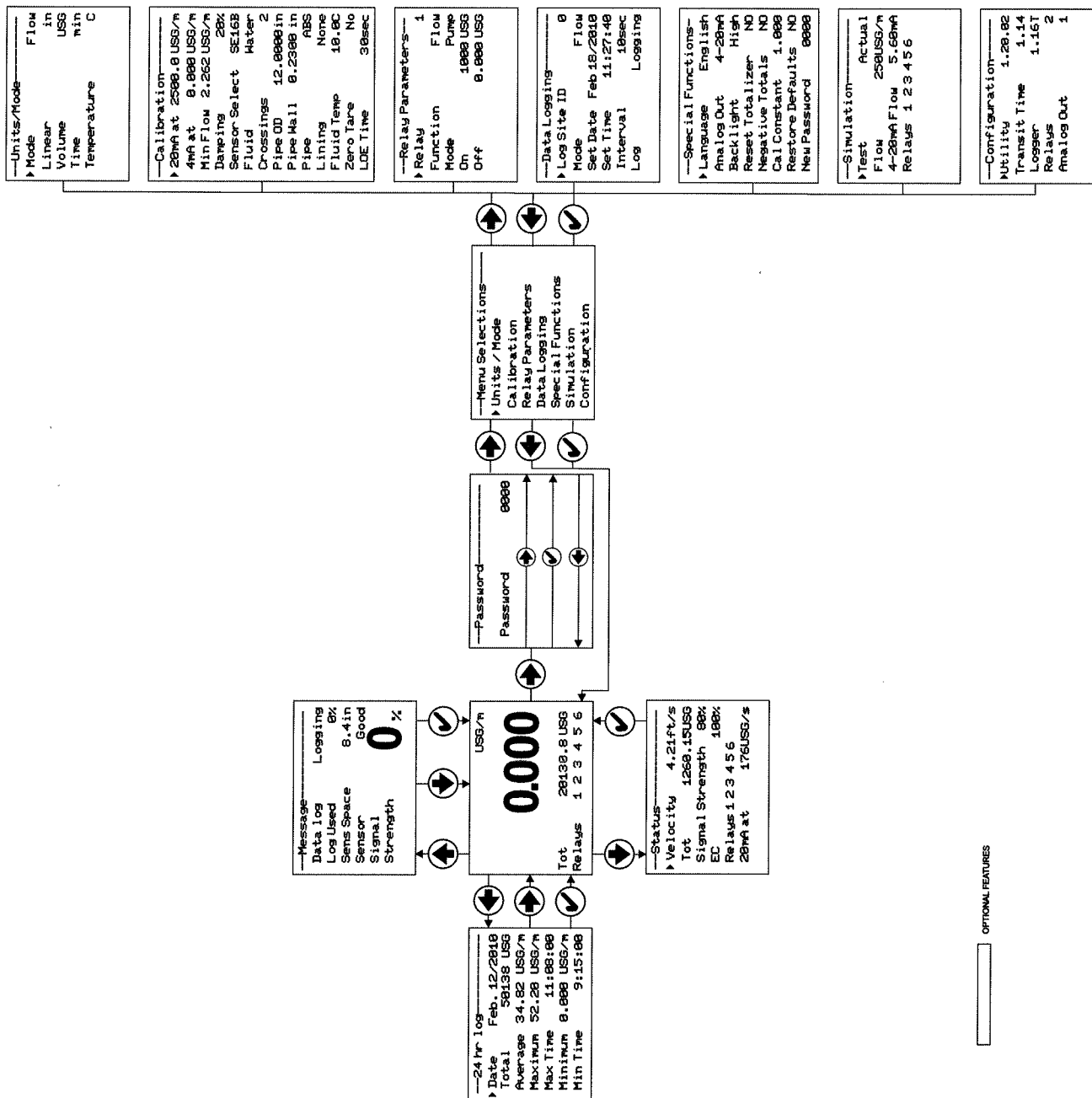
**KEYPAD SYSTEM**

The diagram on page 8 shows the TTFM 1.0 menu system. Arrows show the four directions to leave a menu box. Pressing a corresponding keypad arrow will move to the next item in the direction shown. Move the cursor (underline) under numerals and increase or decrease numerals with the **▲** and **▼** keys.

To store calibration values permanently (even through power interruptions), press the **✓**.



## CALIBRATION MENU



OPTIONAL FEATURES

```

          USG/min
    0.000
Tot      20130.8 USG
Relays   1 2 3 4 5 6
  
```

## RUN

The main display shows the units selected from the Units/Mode menu, Flow or Velocity rate being measured, TOTALIZER and RELAY states. The TTFM 1.0 will start-up with this display and will return to this screen after a timeout if keys are not pressed in other menus.

```

--Message-----
Data log      Logging
Log Used      0%
Sens Space    8.4in
Sensor        Good
Signal        0 %
Strength
  
```

## MESSAGE

Press **↑** from the RUN display to view status of the data logger and error/warning messages provided by the instrument. The word Message will appear on the RUN display if error messages are being generated by the instrument. Refer to the manual section Error/Warning Messages for a description. Press **✓** to return to the main display.

```

--Status-----
▶ Velocity    4.21ft/s
Tot          1260.15USG
Signal Strength 80%
EC           100%
Relays 1 2 3 4 5 6
20mA at      176USG/s
  
```

## STATUS

Press **↓** from the RUN display to view instrument status. Velocity will be displayed in ft/sec or m/sec.

Tot	Displays the current totalizer reading.
Signal Strength	Displays magnitude of signal being received by the ultrasonic transducer.
EC	Echo Confidence - displays percentage of good echoes received.
Relays	Energized relays will display as a white character on a black background.
20mA at	Displays the flow value entered in Calibration menu for 20mA output.



```
--24 hr log-----
►Date      Feb. 12/2010
Total      50138 USG
Average    34.82 USG/m
Maximum    52.20 USG/m
Max Time   11:08:00
Minimum    0.000 USG/m
Min Time   9:15:00
```

### **24 HR LOG (Data Logging option only)**

Press ◀ from the RUN display to view a formatted flow report from instruments with a built-in data logger. Press ↓ to scroll down one day or repeatedly to scroll to a specific date. Up to 365 days can be stored. Newest date will overwrite the oldest. Press ✓ to return to the main display.

```
--Password-----
Password      0000
  ◀────────▶
  ◀────────▶
  ◀────────▶
```

### **PASSWORD**

The password (a number from 0000 to 9999) prevents unauthorized access to the Calibration menu.

From the Run display press the ➡ key to get to **PASSWORD**. Factory default password is 0000 and if it has not been changed press the ✓ to proceed to the Menu Selections screen.

If a password is required, press ➡ to place the cursor under the first digit and ↓ or ↑ to set the number, then ➡ to the second digit, etc. Press ➡ or ✓ to proceed to the Menu Selections screen.

A new password can be stored by going to **Special Functions/New Password**.

```
--Units/Mode-----
>Mode                Flow
Linear              in
Volume             USG
Time               min
Temperature        C
```

## UNITS/MODE

From **>Mode** press the **➡** and then the **⬆** or **⬇** to select **Flow** or **Velocity**. Flow mode displays the flow rate in engineering units (e.g. gpm, litres/sec, etc.) Press the **✓** to store your selection then the **⬇** to the next menu item and **➡** to enter.

```
--Units/Mode-----
Mode                Flow
>Linear             in
                   ft
                   m
                   mm
```

From **>Linear** press the **➡** key and then the **⬆** or **⬇** to select your units of measurement. Press the **✓** to store your selection.

Press the **⬇** key to move the **>** symbol to each subsequent menu item and the **✓** to save your selections.

Note: the volume selection "bbl" denotes U.S. oil barrel.

Press **⬅** or **✓** to return to the Menu Selections screen.

```
--Units/Mode-----
>Volume             USG
                   ft3
                   bbl
                   L
                   m3
                   IMG
                   IG
                   USMG
```

```
--Units/Mode-----
Mode                Flow
Linear              in
Volume             USG
>Time              sec
                   day
                   hr
                   min
```

```

--Calibration-----
> 20mA at 2500.0 USG/m
  4mA at   0.000 USG/m
Min Flow  2.262 USG/m
Damping    20%
Sensor Select SE16B
Fluid      Water
Crossings   2
Pipe OD    12.0000 in
Pipe Wall   0.2300 in
Pipe        ABS
Lining      None
Fluid Temp  10.0C
Zero Tare   No
LOE Time    30sec
  
```

## CALIBRATION

Press **↓** to **>Calibration** and **→** to enter. Use **↓** or **↑** to position **>** before each menu item and **→** to enter. When settings are completed press **✓** to store and return to the Calibration menu.

20mA at

Press **→** then **↓** or **↑** to change the numbers and decimal point. Use this menu to set the corresponding flow rate that will be represented by 20mA analog output. If maximum flow is unknown, enter an estimated flow rate and observe actual flow to determine the correct maximum value. Any velocity or flow rate up to +40 ft/sec (12.2 m/sec) may be selected.

4mA at

Press **↓** or **↑** to set the flow rate corresponding to 4mA analog output. This setting may be left at zero flow (or velocity) or can be raised to any value less than the 20mA setting, or lowered to any velocity or corresponding flow rate down to -40 ft/sec (-12.2 m/sec).

Min Flow

Flow rates below this setting will be displayed as zero flow.

Damping

Increase damping to stabilize readings under turbulent flow conditions. Decrease for fast response to small changes in flow. Damping is shown in percentage (maximum is 99%). Factory default is 20%.

Sensor Select

Choose SE16B (standard) or SE16A (optional).

Fluid

Select fluid type.  
Other will require additional information:

Other/  
Fluid Vel

Enter speed of sound for the fluid. See Appendix C.

Crossings

1 = Z mounting  
2 = V mounting  
4 = W mounting

Pipe OD

Place the cursor under the digits and then **↓** or **↑** to change the numbers and decimal point. Pipe OD should be entered as the exact outside diameter of the pipe where the transducer is mounted. Refer to the Pipe Charts Appendix in this manual for outside diameter of common pipe types and sizes.

Pipe Wall

Enter wall thickness.  
Refer to the Pipe Charts Appendix in this manual for thickness of common pipe materials and sizes.

Pipe	Select pipe material. Other – consult factory.
Other/ Pipe Vel	Consult factory.
Other/ Propagation	Consult factory.
Lining	Enter thickness of bonded liner material. Zero represents no liner.
Fluid Temp	Enter average fluid temperature.
Zero Tare	To suppress readings or fluctuations at zero flow. Under no flow conditions select Yes to force readings to zero.
LOE Time	Loss of Echo alarm after XX seconds.

Press ✓ from the Units/Mode display to return to Menu Selections.

**NOTE:** Transducer separation distance is automatically calculated by the instrument and will be displayed from the main RUN display. From the RUN display press ⬆ to view the Message screen and Sens Space will be displayed.

```
--Relay Parameters--
▶Relay              1
Function            Flow
Mode                Pump
On                  1000 USG
Off                  0.000 USG
```

## RELAY PARAMETERS

**Relay** Press **➡** and **↓** or **↑** to select a corresponding relay number (2 relays are standard, 4 additional are optional).

**Function** Press **↓** or **↑** to select **Off**, **Pulse** or **Flow**.

**Flow** Mode Select **Pump**, **Low Alarm** or **Hi Alarm**.

**Pump** mode provides separate On/Off settings where the relay will energize at one flow rate and de-energize at another.

**On** Position the cursor under the numerals and press **↓** or **↑** to set digits to the required relay **On** set point.

**Off** set digits to the required **Off** set point.

**Low Alarm** mode relay will energize at a programmable flow rate and remain energized with flow below the set point. When flow rises above the set point, the relay will de-energize.

**Hi Alarm** mode relay will energize at a programmable flow rate and remain energized with flow above the set point. When flow falls below the set point, the relay will de-energize.

**Pulse** Press **↓** and set digits to the flow volume increment required between relay pulses. Use this feature for remote samplers, chlorinators or totalizers. Minimum time between pulses is 2.25 seconds and pulse duration is 350 milliseconds.

Return to **Relay** and change settings for each relay number.

Press **✓** to return to **Menu Selections**.

## DATA LOGGING (OPTIONAL)

Refer to Options section of this manual.

```
--Special Functions--
▶ Language      English
Analog Out      4-20mA
Backlight       High
Reset Totalizer NO
Negative Totals NO
Cal Constant    1.000
Restore Defaults NO
New Password     0000
```

## SPECIAL FUNCTIONS

Language	Select English, French or Spanish
Analog Out	Select 4-20mA or 0-5V mode for the analogue output.
Backlight	Select High, Medium or Low for continuous backlight.  Select Key Hi/Lo for high backlight for 1 minute after a keypress and then Lo backlight until a key is pressed again.  Select Key High, Med or Low for backlight for 1 minute after a keypress and then backlight off until a key is pressed again.
Reset Totalizer	Press <b>►</b> and select <b>Yes</b> to erase and restart the totalizer at zero.
Negative Totals	Select <b>Yes</b> to have reverse flow readings deducted from the totalizer. Select <b>No</b> to totalize forward flow only and ignore reverse flow.
Cal Constant	Set to 1.000 for SE16B transducer.
Restore Defaults	Select <b>Yes</b> and press <b>✓</b> to erase all user settings and return the instrument to factory default settings.
New Password	Select any number from 0000 to 9999 and press <b>✓</b> . Default setting of 0000 will allow direct access to the calibration menus. Setting of any password greater than 0000 will require the password to be entered to access the calibration menus.

Press **✓** to return to **Menu Selections**.

## **SIMULATION**

```
--Simulation-----
>Test           Actual
Flow            250USG/m
4-20mA Flow     5.60mA
Relays 1 2 3 4 5 6
```

Exercises the 4-20mA output, digital display and control relays (does not affect the totalizer or optional data logger).

Simulate a **Flow/Velocity** reading. Press **➡** and then **⬇** or **⬆** to change the simulated output. Press **✓** to begin simulation. The 4-20mA output and relay states will be displayed on the screen below.

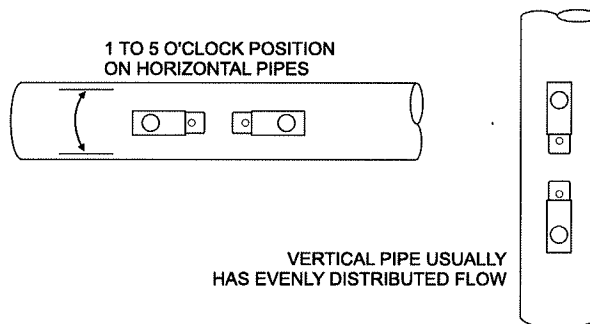
Press the **✓** to terminate simulation and return to the **Menu Selections** screen.

## **TRANSDUCER MOUNTING LOCATION**

The position of the transducer is one of the most important considerations for accurate Transit Time flow measurement. The same location guidelines apply to Transit Time as most other types of flow meters.

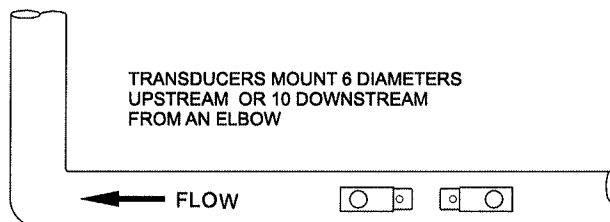
Before permanently mounting a Transit Time transducer onsite testing is recommended to determine optimum mounting position. Use the transducer coupling compound (supplied with each Greyline flow meter, or petroleum gel, acoustic compound or electrocardiograph gel). Take several readings around the axis of the pipe and then at several points upstream and downstream from the selected position, checking for consistent readings. Avoid high or low reading areas. Mount the transducers where consistent (average) readings were obtained or continue testing on another pipe section.

**VERTICAL OR HORIZONTAL PIPE** - Vertical pipe runs generally provide evenly distributed flow. On Horizontal pipes and liquids with high concentrations of gas or solids, the transducers should be mounted on the side (1 to 5 o'clock positions) to avoid concentrations of gas at the top of the pipe, or solids at the bottom.



**VELOCITY INCREASING DEVICES:** Generally the transducers must be mounted away from flow disturbances such as valves, pumps, orifice plates, venturis or pipe inlets and discharges which tend to increase flow velocity. Velocity increasing devices often cause cavitation, or rapid release of gas bubbles, and readings both up and downstream may be intermittent or inaccurate. As a guideline, mount the transducer at least 20 diameters upstream or 30 diameters downstream from velocity increasing devices.

Required distance from a velocity increasing device will vary in applications depending on the flow velocity and the characteristics of the liquid itself.



**TURBULENCE INCREASING DEVICES:** Elbows, flanged connections and tees tend to introduce desirable conditions of an evenly distributed flow profile. Transducer mounting 6 pipe diameters upstream and 10 diameters downstream from these disturbances is generally optimum.

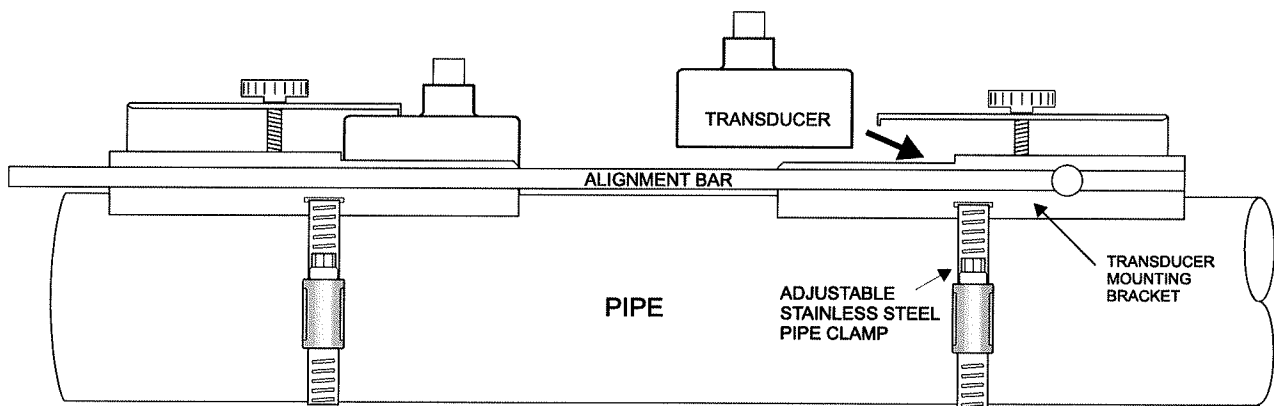
The transducers are designed to mount longitudinally on a straight section of pipe. Do not attempt to mount it on bends, elbows or fittings.



## **TRANSDUCER MOUNTING**

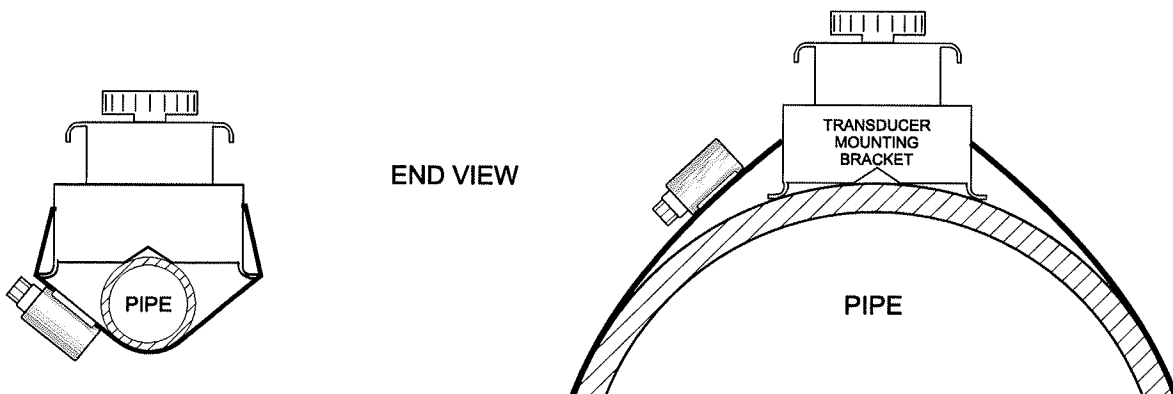
Prepare an area 2" wide by 4" long (50mm x 100mm) for transducer bonding by removing loose paint, scale and rust. The objective of site preparation is to eliminate any discontinuity between the transducer and the pipe wall, which would prevent acoustical coupling.

A TMK1 Transducer Mounting Kit is supplied with each Greyline flow meter. It includes recommended coupling compound in a plastic applicator and a stainless steel mounting bracket with adjustable pipe straps. Use the Alignment Bar (included) to align transducer brackets for V and W mode mounting.



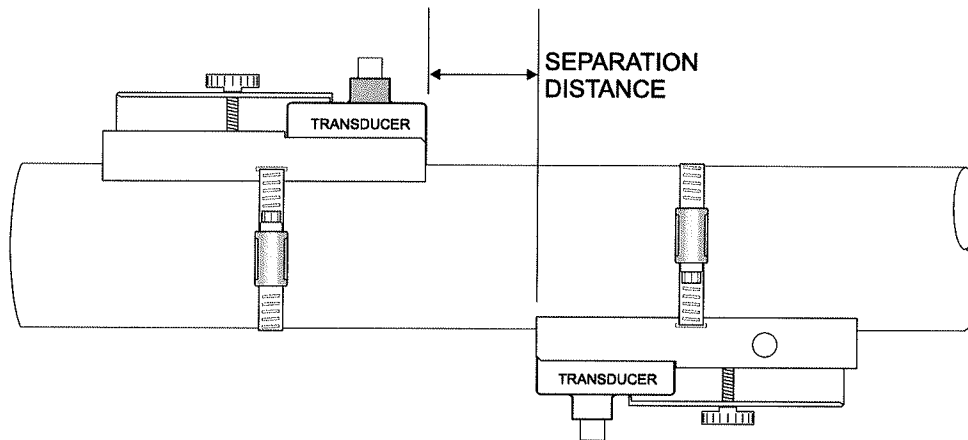
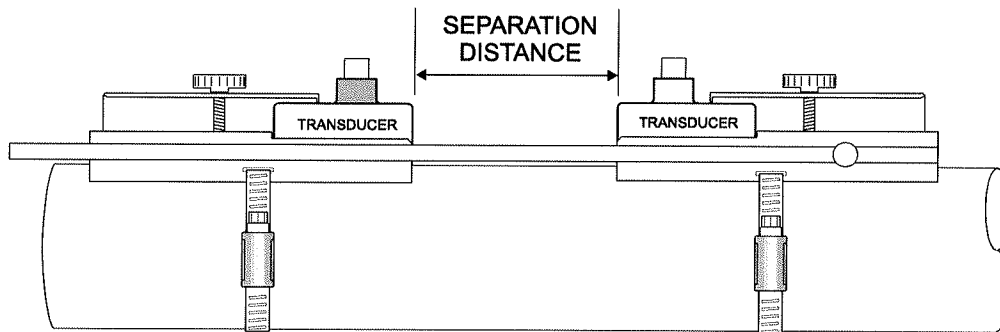
Mount the PC16 Mounting Bracket as illustrated on pipes 0.6" / 15 mm OD or larger. Stainless steel bands are included for mounting on pipes up to 30" / 750 mm OD.

Additional stainless steel bands (by customer) may be combined to mount on larger pipes.



## **SEPARATION DISTANCE**

Measure separation distance with a ruler or tape measure. Separation distance is automatically calculated by the TTFM 1.0 based on parameters entered in the **Calibration** menu. To view separation distance from the **RUN** display press **▲** to view the **Message** screen where **Sens Space** is displayed.



## **TRANSDUCER COUPLING**

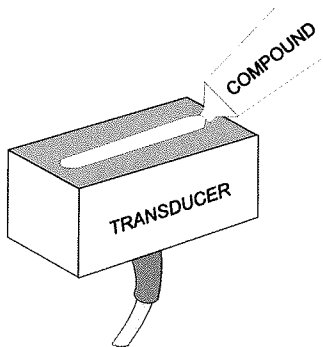
For permanent or temporary bonding, the following are recommended:

- a) Dow Corning silicon compound #4 (supplied)  
Additional supply: order Greyline Option CC
- b) High Temperature compound (supplied with Transducer Option SE3H)  
Additional supply: order Greyline Option AP-1W
- c) Water-based sonic compound: Order Greyline Option CC30
- d) Electrocardiograph gel
- e) Petroleum gel (Vaseline)

The above are arranged in their order of preferred application.

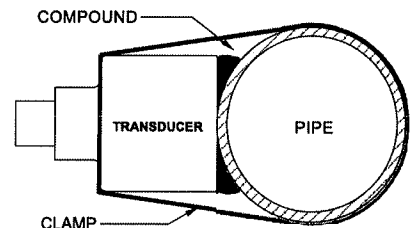
d & e are only good for temporary bonding at room temperature.

**DO NOT USE:** Silicon RTV caulking compound (silicon rubber).



Use the pipe clamp and rail (supplied) as illustrated above or use a loop of electrical tape for temporary mounting. Apply silicon coupling compound #4 to the colored face of the transducer. A bead, similar to toothpaste on a toothbrush, is ideal. Do not overtighten (crush the transducer).

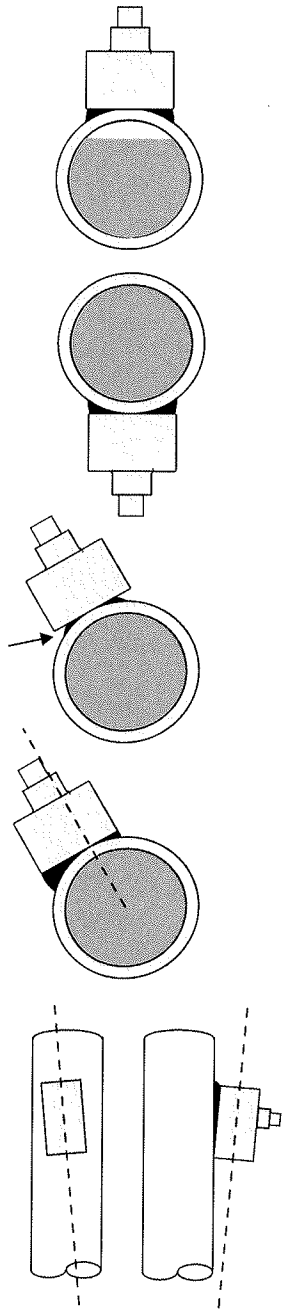
The transducer must be fixed securely to the pipe with coupling material between the transducer face and the pipe. Transducer installation with excessive coupling compound can result in gaps or voids in the coupling and cause errors or loss of signal. Insufficient coupling compound will create similar conditions.



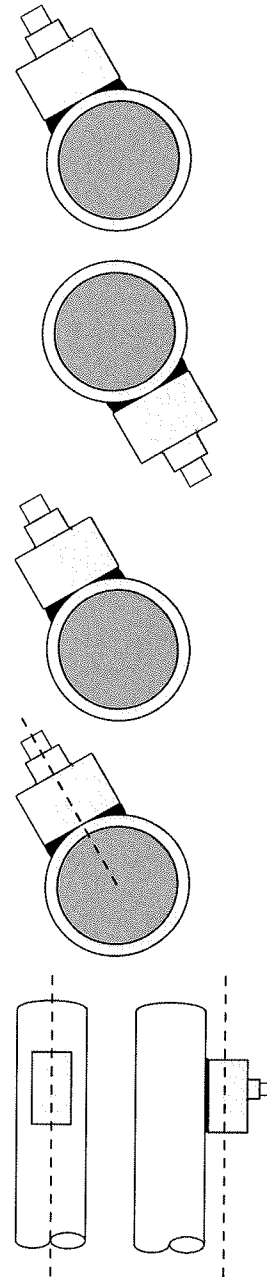
Over time temporary coupling compounds (e.g. Petroleum Gel) may gradually sag away from the transducer resulting in reduced signal strength and finally complete loss of signal. Warm temperatures, moisture and vibration will accelerate this process. Dow Corning Silicone Compound #4 as supplied with the TTFM 1.0 (and available from Greyline Instruments) is recommended for semi-permanent installations.

**TRANSDUCER MOUNTING/COUPLING RECOMMENDATIONS**

**BAD**



**GOOD**



## **APPENDIX H**

### **Sample Outfall 503 Discharge Monitoring Report for Each Sample Event**

## SAMPLE EVENT DISCHARGE MONITORING REPORT

**FACILITY NAME** Dominion Possum Point Power Station  
**PERMIT NO.** VA0002071  
**OUTFALL NUMBER** 503  
**DATE COLLECTED**  
**SAMPLER NAME**

Parameters	Units	Limits				Result
		Monthly Average	Daily Maximum	Minimum	Maximum	
Estimated Flow	MGD	NL	NA	NA	NL	
pH <sup>(1)</sup>	S.U.	NA	NA	6.0	9.0	
Total Suspended Solids (TSS)	mg/L	30	100	NA	NA	
Oil and Grease (O&G)	mg/L	15	20	NA	NA	
Aluminum, Total	µg/L	NL	NL	NA	NA	
Antimony, Total	µg/L	640	640	NA	NA	
Arsenic, Total	µg/L	220	220	NA	NA	
Barium, Total	µg/L	NL	NL	NA	NA	
Beryllium, Total	µg/L	NL	NL	NA	NA	
Boron, Total	µg/L	NL	NL	NA	NA	
Cadmium, Total	µg/L	1.1	1.1	NA	NA	
Chloride	µg/L	340,000	340,000	NA	NA	
Chromium III, Total	µg/L	73	73	NA	NA	
Chromium VI, Total	µg/L	16	16	NA	NA	
Cobalt, Total	µg/L	NL	NL	NA	NA	
Copper, Total	µg/L	8.4	8.4	NA	NA	
Iron, Total	µg/L	NL	NL	NA	NA	
Lead, Total	µg/L	11	11	NA	NA	
Mercury, Total	µg/L	1.1	1.1	NA	NA	
Molybdenum, Total	µg/L	NL	NL	NA	NA	
Nickel, Total	µg/L	19	19	NA	NA	
Selenium, Total	µg/L	7.3	7.3	NA	NA	
Silver, Total	µg/L	1.5	1.5	NA	NA	
Thallium, Total	µg/L	0.47	0.47	NA	NA	
Vanadium, Total	µg/L	NL	NL	NA	NA	
Zinc, Total	µg/L	77	77	NA	NA	
Hardness, Total (as CaCO <sub>3</sub> )	mg/L	NL	NL	NA	NA	
Acute Toxicity – <i>C. dubia</i> <sup>(2)</sup>	% NOEC	NA	NA	100%	NA	
Acute Toxicity – <i>P. promelas</i> <sup>(2)</sup>	% NOEC	NA	NA	100%	NA	
Chronic Toxicity – <i>C. dubia</i> <sup>(3)</sup>	TU <sub>c</sub>	NA	NA	NA	1.44	
Chronic Toxicity – <i>P. promelas</i> <sup>(3)</sup>	TU <sub>c</sub>	NA	NA	NA	1.44	

Footnotes:

1) pH value measured in field.

2) Reported as percent No Observed Effect Concentration (NOEC).

3) Reported as Chronic Toxicity Units (TU<sub>c</sub>).

4) Values preceded by "<" represent results not detected at the Reporting Detection Limit (RDL) and listed as < RDL.

5) Values with suffix "±" represent results with an estimated value between the Method Detection Limit (MDL) and the Practical Quantitation Limit (PQL) for the analyte

6) NA = Not Applicable

7) NL = No Limit

8) MGD = Million Gallons Per Day

00014329

## **APPENDIX I**

### **Example Monthly Discharge Monitoring Report to DEQ**

COMMONWEALTH OF VIRGINIA  
DEPARTMENT OF ENVIRONMENTAL QUALITY  
NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM(NPDES)  
DISCHARGE MONITORING REPORT(DMR)

Industrial Major 02/02/2016  
DEPT. OF ENVIRONMENTAL QUALITY  
(REGIONAL OFFICE)

NAME Dominion - Possum Point Power Station  
ADDRESS 5000 Dominion Blvd  
Glen Allen VA 23060  
FACILITY LOCATION 19000 Possum Point Rd

VA0002071		503	
PERMIT NUMBER		DISCHARGE NUMBER	
MONITORING PERIOD			
YEAR	MO	DAY	TO

Northern Regional Office  
13901 Crown Court  
Woodbridge VA 22193

NOTE: READ PERMIT AND GENERAL INSTRUCTIONS  
BEFORE COMPLETING THIS FORM.

FROM

PARAMETER	QUANTITY OR LOADING		QUALITY OR CONCENTRATION			NO. EX.	FREQUENCY OF ANALYSIS	SAMPLE TYPE
	AVERAGE	MAXIMUM	UNITS	MINIMUM	AVERAGE	MAXIMUM	UNITS	
001 FLOW	*****			*****	*****	*****		
	*****	2.88	MGD	*****	*****	*****	0	3D/W EST
002 pH	*****				*****			
	*****				*****			
004 TSS	*****			6.0	*****	9.0	SU	GRAB
	*****			*****				
090 MOLYBDENUM, TOTAL (AS MO)	*****			*****				
	*****			*****	30	100	MG/L	4HC
137 HARDNESS, TOTAL (AS CACO3)	*****			*****				
	*****			*****	NL	NL	UG/L	4HC
145 CHLORIDES	*****			*****				
	*****			*****	NL	NL	MG/L	4HC
185 NICKEL, TOTAL RECOVERABLE	*****			*****				
	*****			*****	370000	670000	UG/L	4HC
186 SILVER, TOTAL RECOVERABLE	*****			*****				
	*****			*****	24	44	UG/L	4HC
	*****			*****				
	*****			*****	2.2	4.0	UG/L	4HC

ADDITIONAL PERMIT REQUIREMENTS OR COMMENTS  
These effluent limitations are applicable when Internal Outfall 503 is routed through Outfall 001/002 or Outfall 004. .

BYPASSES AND OVERFLOWS		TOTAL OCCURRENCES	TOTAL FLOW(M.G.)	TOTAL BOD5(K.G.)	OPERATOR IN RESPONSIBLE CHARGE			DATE		
I CERTIFY UNDER PENALTY OF LAW THAT THIS DOCUMENT AND ALL ATTACHMENTS WERE PREPARED UNDER MY DIRECTION OR SUPERVISION IN ACCORDANCE WITH A SYSTEM DESIGNED TO ASSURE THAT QUALIFIED PERSONNEL PROPERLY GATHER AND EVALUATE THE INFORMATION SUBMITTED. BASED ON MY INQUIRY OF THE PERSON OR PERSONS WHO MANAGE THE SYSTEM OR THOSE PERSONS DIRECTLY RESPONSIBLE FOR GATHERING THE INFORMATION, THE INFORMATION SUBMITTED IS TO THE BEST OF MY KNOWLEDGE AND BELIEF TRUE, ACCURATE AND COMPLETE. I AM AWARE THAT THERE ARE SIGNIFICANT PENALTIES FOR SUBMITTING FALSE INFORMATION, INCLUDING THE POSSIBILITY OF FINE AND IMPRISONMENT FOR KNOWING VIOLATIONS.					TYPED OR PRINTED NAME	SIGNATURE	CERTIFICATE NO.	YEAR	MO.	DAY
					PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT					
					TELEPHONE					
					TYPED OR PRINTED NAME	SIGNATURE	YEAR	MO.	DAY	

00014333



COMMONWEALTH OF VIRGINIA  
DEPARTMENT OF ENVIRONMENTAL QUALITY  
NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM(NPDES)  
DISCHARGE MONITORING REPORT(DMR)

Industrial Major 02/02/2016  
DEPT. OF ENVIRONMENTAL QUALITY  
(REGIONAL OFFICE)

NAME Dominion - Possum Point Power Station  
ADDRESS 5000 Dominion Blvd  
Glen Allen VA 23060  
FACILITY LOCATION 19000 Possum Point Rd

VA0002071		503	
PERMIT NUMBER		DISCHARGE NUMBER	
MONITORING PERIOD			
YEAR	MO	DAY	TO

Northern Regional Office  
13901 Crown Court  
Woodbridge VA 22193  
NOTE: READ PERMIT AND GENERAL INSTRUCTIONS  
BEFORE COMPLETING THIS FORM.

FROM

PARAMETER	QUANTITY OR LOADING			QUALITY OR CONCENTRATION			NO. EX.	FREQUENCY OF ANALYSIS	SAMPLE TYPE
	AVERAGE	MAXIMUM	UNITS	MINIMUM	AVERAGE	MAXIMUM			
193 THALLIUM, TOTAL (AS TL)	*****	*****		*****					
	*****	*****		*****	0.94	0.94	0	3D/W	4HC
196 ZINC, TOTAL RECOVERABLE	*****	*****		*****					
	*****	*****		*****	98	180	0	3D/W	4HC
202 CADMIUM, TOTAL RECOVERABLE	*****	*****		*****					
	*****	*****		*****	1.4	2.6	0	3D/W	4HC
203 COPPER, TOTAL RECOVERABLE	*****	*****		*****					
	*****	*****		*****	9.6	18	0	3D/W	4HC
212 ARSENIC, TOTAL RECOVERABLE	*****	*****		*****					
	*****	*****		*****	240	440	0	3D/W	4HC
233 LEAD, TOTAL RECOVERABLE	*****	*****		*****					
	*****	*****		*****	14	26	0	3D/W	4HC
235 MERCURY, TOTAL RECOVERABLE	*****	*****		*****					
	*****	*****		*****	1.2	2.2	0	3D/W	4HC
237 COBALT, TOTAL (AS CO)	*****	*****		*****					
	*****	*****		*****	NL	NL	0	1/M	4HC

ADDITIONAL PERMIT REQUIREMENTS OR COMMENTS  
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BYPASSES AND OVERFLOWS	TOTAL OCCURRENCES	TOTAL FLOW(M.G.)	TOTAL BOD5(K.G.)	OPERATOR IN RESPONSIBLE CHARGE		DATE	
				TYPED OR PRINTED NAME	SIGNATURE	CERTIFICATE NO.	YEAR
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				TYPED OR PRINTED NAME	SIGNATURE	YEAR	MO.

COMMONWEALTH OF VIRGINIA  
DEPARTMENT OF ENVIRONMENTAL QUALITY  
NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM(NPDES)  
DISCHARGE MONITORING REPORT(DMR)

PERMITTEE NAME/ADDRESS(INCLUDE  
FACILITY NAME/LOCATION IF DIFFERENT)

NAME Dominion - Possum Point Power Station  
ADDRESS 5000 Dominion Blvd  
Glen Allen VA 23060  
FACILITY LOCATION 19000 Possum Point Rd

Industrial Major

02/02/2016

DEPT. OF ENVIRONMENTAL QUALITY  
(REGIONAL OFFICE)

Northern Regional Office  
13901 Crown Court

Woodbridge VA 22193

NOTE: READ PERMIT AND GENERAL INSTRUCTIONS  
BEFORE COMPLETING THIS FORM.

VA0002071		503	
PERMIT NUMBER		DISCHARGE NUMBER	
MONITORING PERIOD			
YEAR	MO	DAY	TO
		YEAR	MO
		DAY	

FROM

PARAMETER	QUANTITY OR LOADING		QUALITY OR CONCENTRATION				NO. EX.	FREQUENCY OF ANALYSIS	SAMPLE TYPE
	AVERAGE	MAXIMUM	UNITS	MINIMUM	AVERAGE	MAXIMUM			
314 CHROMIUM, HEXAVALENT TOTAL RECOVERABLE	*****	*****	*****	*****					
	*****	*****	*****	*****	17	32	0	3D/W	4HC
361 IRON, TOTAL RECOVERABLE	*****	*****	*****	*****					
	*****	*****	*****	*****	NL	NL	0	1/M	4HC
372 BORON, TOTAL	*****	*****	*****	*****					
	*****	*****	*****	*****	NL	NL	0	1/M	4HC
408 SELENIUM, TOTAL RECOVERABLE	*****	*****	*****	*****					
	*****	*****	*****	*****	8.0	15	0	3D/W	4HC
409 VANADIUM, TOTAL RECOVERABLE	*****	*****	*****	*****					
	*****	*****	*****	*****	NL	NL	0	1/M	4HC
410 ALUMINUM, TOTAL RECOVERABLE	*****	*****	*****	*****					
	*****	*****	*****	*****	NL	NL	0	1/M	4HC
449 BARIUM, TOTAL RECOVERABLE	*****	*****	*****	*****					
	*****	*****	*****	*****	NL	NL	0	1/M	4HC
500 OIL & GREASE	*****	*****	*****	*****					
	*****	*****	*****	*****	15	20	0	3D/W	4HC

ADDITIONAL PERMIT REQUIREMENTS OR COMMENTS

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BYPASSES AND OVERFLOWS	TOTAL OCCURRENCES	TOTAL FLOW(M.G.)		TOTAL BOD5(K.G.)		OPERATOR IN RESPONSIBLE CHARGE		DATE			
						TYPED OR PRINTED NAME	SIGNATURE	CERTIFICATE NO.	YEAR	MO.	
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						TYPED OR PRINTED NAME	SIGNATURE	YEAR	MO.	DAY	
						TYPED OR PRINTED NAME	SIGNATURE	YEAR	MO.	DAY	

00014335

COMMONWEALTH OF VIRGINIA  
DEPARTMENT OF ENVIRONMENTAL QUALITY  
NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM(NPDES)  
DISCHARGE MONITORING REPORT(DMR)

Industrial Major 02/02/2016  
DEPT. OF ENVIRONMENTAL QUALITY  
(REGIONAL OFFICE)  
Northern Regional Office  
13901 Crown Court  
Woodbridge VA 22193

PERMITTEE NAME/ADDRESS(INCLUDE  
FACILITY NAME/LOCATION IF DIFFERENT)

NAME Dominion - Possum Point Power Station  
ADDRESS 5000 Dominion Blvd  
Glen Allen VA 23060  
FACILITY 19000 Possum Point Rd  
LOCATION

VA0002071		503	
PERMIT NUMBER		DISCHARGE NUMBER	
MONITORING PERIOD			
YEAR	MO	DAY	TO

FROM

NOTE: READ PERMIT AND GENERAL INSTRUCTIONS  
BEFORE COMPLETING THIS FORM.

PARAMETER	QUANTITY OR LOADING		QUALITY OR CONCENTRATION			NO. EX.	FREQUENCY OF ANALYSIS	SAMPLE TYPE
	AVERAGE	MAXIMUM	UNITS	MINIMUM	AVERAGE	MAXIMUM	UNITS	
704 NOAEC - ACUTE 48 HR STAT CERIODAPHNIA DUBIA	*****	*****			*****	*****		
	*****	*****		100	*****	*****	%	1/M
705 NOAEC - ACUTE 48 HR STAT PIMEPHELES PROMELAS	*****	*****			*****	*****		
	*****	*****		100	*****	*****	%	1/M
720 TUC - CHRONIC 3-BROOD STATRE CERIODAPHNIA DUBIA	*****	*****			*****	*****		
	*****	*****		*****	*****	2.85	TU-C	1/M
721 TUC - CHRONIC 7-DAY STATRE PIMEPHELES PROMELAS	*****	*****			*****	*****		
	*****	*****		*****	*****	2.85	TU-C	1/M
796 BERYLLIUM, TOTAL RECOVERABLE (AS BE)	*****	*****			*****	*****		
	*****	*****		*****	NL	NL	UG/L	1/M
797 ANTIMONY, TOTAL RECOVERABLE (AS SB)	*****	*****			*****	*****		
	*****	*****		*****	1300	1300	UG/L	3D/W
939 CHROMIUM, TRIVALENT TOTAL RECOVERABLE	*****	*****			*****	*****		
	*****	*****		*****	88	160	UG/L	3D/W
REPORTD								
REQRMNT								*****

ADDITIONAL PERMIT REQUIREMENTS OR COMMENTS  
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BYPASSES AND OVERFLOWS	TOTAL OCCURRENCES	TOTAL FLOW(M.G.)	TOTAL BOD5(K.G.)	OPERATOR IN RESPONSIBLE CHARGE		DATE		
				TYPED OR PRINTED NAME	SIGNATURE	CERTIFICATE NO.	YEAR	
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				TYPED OR PRINTED NAME	SIGNATURE	YEAR	MO.	
				TYPED OR PRINTED NAME	SIGNATURE	YEAR	MO.	

00014336

This report is required by your VPDES permit and by law. (See, e.g., the Code of Virginia of 1950 §62.1-44.5 and 9 VAC 25-31-50.) Failure to report or failure to report truthfully can result in civil penalties of \$32,500 per violation, per day and felony prosecutions which can carry a 15 year term.

### DISCHARGE MONITORING REPORT (DMR) - GENERAL INSTRUCTIONS

1. Complete this form in permanent ink or indelible pencil. The use of 'correction fluid/tape' is not allowed.
2. Be sure to enter the dates for the first and last day of the period covered by the report on the form in the space marked "Monitoring Period".
3. For those parameters where the "permit requirement" spaces have a requirement or limitation, provide data in the "reported" spaces in accordance with your permit.
4. Enter the average and maximum quantities and units in the "reported" spaces in the columns marked "Quantity or Loading".  
 $\text{KG/DAY} = \text{Concentration (mg/L)} \times \text{Flow (MGD)} \times 3.785$        $\text{G/D (Grams/Day)} = \text{Concentration (mg/L)} \times \text{Flow (MGD)} \times 3785$
5. Enter maximum, minimum, and/or average concentrations and units in the "reported" spaces in the columns marked "Quality or Concentration".
6. For all parameters enter the number of samples which do not comply with the maximum and/or minimum permit requirements in the "reported" space in the column marked "No. Ex." (Number of Exceedances). If none, enter "0". Do NOT include monthly average violations in this field. Include any Maximum 7-Day Average and Maximum Weekly Average violations in this field. Permittees with continuous pH, or temperature monitoring requirements should consult the permit for what constitutes an exceedance and report accordingly.
7. You are required to sample (at a minimum) according to the Sample Frequencies and Sample Types specified in your permit.
8. Enter the actual frequency of analysis for each parameter (number of times per day, week, month, etc.) in the "reported" space in the column marked "Frequency of Analysis".
9. Enter the actual type of sample (Grab, 8HC, 24HC, etc) collected for each parameter in the "reported" space in the column marked "Sample Type".
10. Enter additional required data or comments in the space marked "additional permit requirements or comments". If additional required data or comments are appended to the DMR, reference appended correspondence in this field.
11. Record the number of bypasses during the month, the total flow in million gallons (MG) and BOD5 in kilograms (KG) in the proper columns in the section marked "Bypasses and Overflows".
12. The operator in responsible charge of the facility should review the form and sign in the space provided. If the plant is required to have a licensed operator or if the operator in responsible charge of the facility is a licensed operator, the operator's signature and certificate number must be reported in the spaces provided.
13. The principal executive officer then reviews the form and must sign in the space provided and provide a telephone number where he/she can be reached. Every page of the DMR must have an original signature.
14. Send the completed form(s) with original signatures to your Department of Environmental Quality Regional Office by the 10th of each month unless otherwise specified in the permit.
15. You are required to retain a copy of the report for your records.
16. Where violations of permit requirements are reported, attach a brief explanation in accordance with the permit requirements describing causes and corrective actions taken. Reference each separate violation by date.
17. If you have any questions, contact the Department of Environmental Quality Regional Office listed on the DMR.